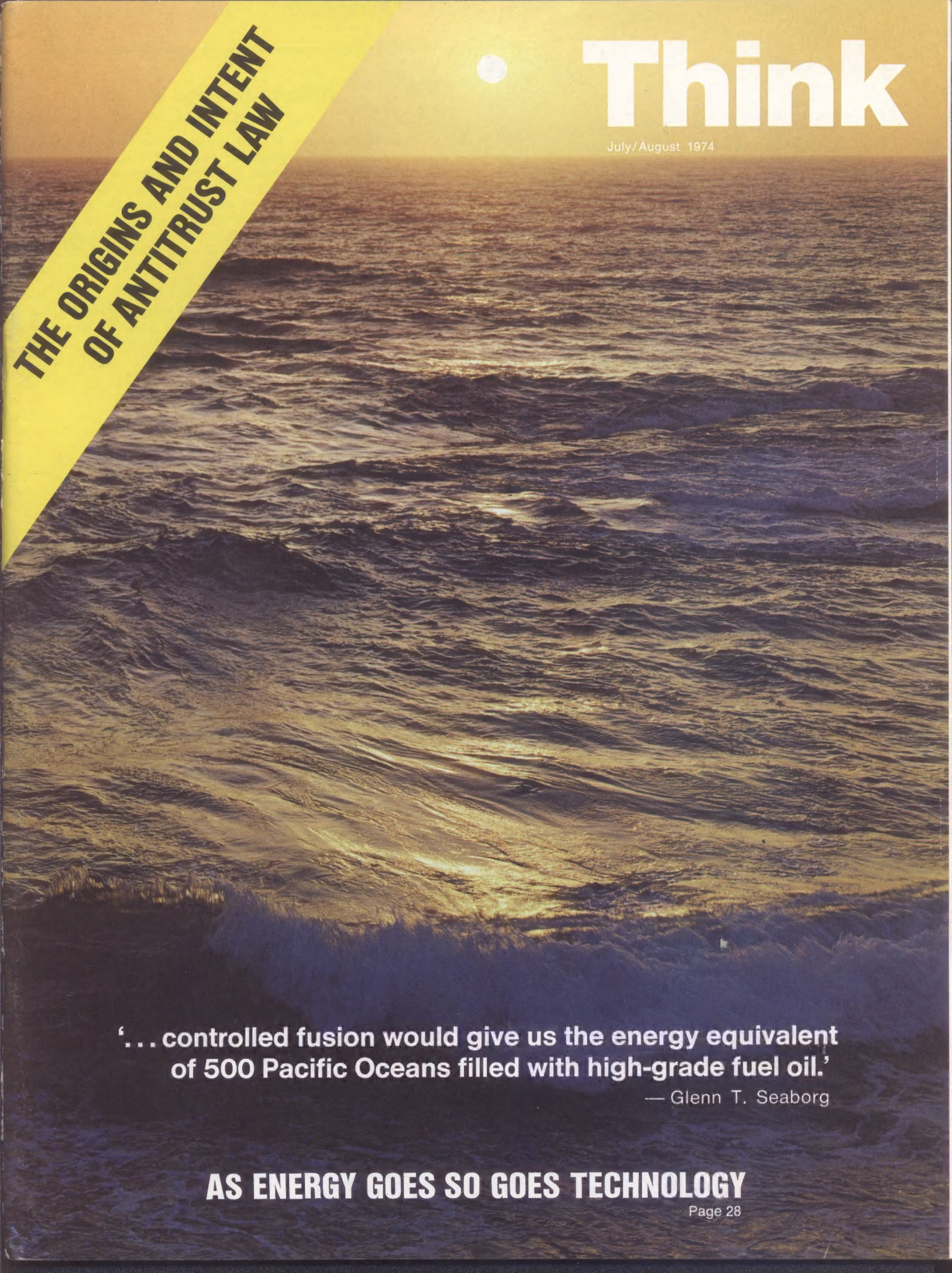
Think

July/August 1974

THE ORIGINS AND INTENT OF ANTITRUST LAW



'. . . controlled fusion would give us the energy equivalent of 500 Pacific Oceans filled with high-grade fuel oil.'

— Glenn T. Seaborg

AS ENERGY GOES SO GOES TECHNOLOGY

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Arthur Kittredge Watson
1919-1974

Dick Watson—as he was known to thousands of IBMers, statesmen, and businessmen around the world—died Friday, July 26. He spent most of his professional life in the IBM World Trade Corporation which he helped to architect and then build in his 21 years with that organization. In 1970, he resigned as IBM vice chairman to become U.S. Ambassador to France. On his return in 1972, he again became a director of IBM and was elected a member of the Executive Committee. *Think* chronicles his long career with IBM in a special section beginning on page 10.

Letter from the Chairman

He left us a vision of a world united

I know I speak for all his colleagues and friends in IBM in saying that the untimely passing of Arthur K. Watson leaves all of us with a great feeling of loss.

IBM World Trade is, in a sense, a living monument to Dick Watson. He understood very well the barriers of history and culture that divide nation from nation—but he saw beyond the barriers. He enjoyed the diversity of peoples—but he saw beyond the differences. He saw, in fact, a world united by shared goals and common understanding.

He devoted himself to advancing those goals and promoting that understanding. Building on his father's vision, he extended IBM's business to more than a hundred nations, and helped make IBM a symbol of good citizenship around the world. As president of the International Chamber of Commerce, he advocated international trade to business people throughout the world. As a co-founder of the Emergency Committee for American Trade, he made his own personal stand for freer trade. As American Ambassador to France, he made a major and little publicized effort to shut off the heroin pipeline from Marseilles to New York; and he made the first official diplomatic contacts with the government of the People's Republic of China.

His achievements as an internationalist in thought and practice will always stand as an inspiration to IBMers.

Frank Cary

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Features

The quote on the cover is from Glenn T. Seaborg, Nobel Laureate in Chemistry and former chairman of the AEC.

Think The contents of this issue, in brief

ISSUES

Antitrust laws go back to 1890 and the Sherman Act, which was passed to curb the oil, steel, and whiskey trusts of that era. How has that law and the Clayton Act of 1914 been applied, over the decades, to cases involving monopoly and competition? Professor Eugene V. Rostow of the Yale Law School traces the evolution of antitrust law in the United States, the reasons behind it, and the philosophy of antitrust that appears to have emerged. He takes a close look at economic "monopoly power" as interpreted in the *Alcoa* case of 1945 and the *United Shoe Machinery Company* case of 1953. After analyzing these decisions, Rostow concludes that Telex's claims for antitrust damages against IBM are without legal foundation.

THE WORLD

Arthur K. Watson, IBM vice chairman of the board before he resigned to become U.S. Ambassador to France, built the company's overseas operation. He started at his father's side, traveling to Europe at age 3, and soon developed his own flair for dealing with people and events on an international scale. From 1949 to 1970, Watson spurred IBM World Trade Corp., sales from less than $50-million to more than $2.5-billion. Along the way, he became an "ambassador-at-large" for the company, spending much of his time outside the U.S., selecting managers, expanding the business, and putting his energies against the complicated, often unique problems of conducting a worldwide enterprise. *Think* profiles his life in IBM, the company's growth during his career, and his service as U.S. Ambassador in Paris.

In a separate article, a longtime colleague, Jack Brent, chairman of the board of IBM Canada, reminisces about the early days with Dick Watson. His tribute is filled with anecdotes that reveal the personality as well as the business acumen of the man.

What encircles three-quarters of the globe, takes in four continents, and is one of the fastest growing operating units in IBM? The answer: IBM World Trade Americas/Far East Corporation, more familiarly referred to as A/FE. Earlier this summer, overseas managers met with A/FE Board Chairman Ralph A. Pfeiffer, Jr., and his staff in Bermuda to speed the start-up of the organization and firm up plans for the future.

Pfeiffer and his country managers spelled out in tables of facts and figures what the organization very clearly intends to do. No other area of the business faces such complexities and diversities. Among them: language and cultural differences, global inflation, and high costs of doing business.

Despite these obstacles, the Bermuda meeting emphasized the opportunity ahead. Guest speaker C. Fred Bergsten of The Brookings Institution observed that many of the A/FE lands are rich in the mineral and natural resources now in high demand everywhere in the industrialized world. A/FE clearly sees its three-quarters of the globe as a world whose time has come.

TECHNOLOGY

Man's fascination with nuclear energy has been with us for decades, but the recent energy crisis—and the continuing threat of world fuel shortage—has brought the atom's potential into sharper focus. Its advantages are clear-cut: Small amounts of nuclear fuel can produce vast amounts of heat, generating steam to drive giant turbo-generators. A cubic foot of uranium, for instance, equals 7.2 *million* barrels of oil. A pound of nuclear fuel equals 75 tons of high-quality coal. At those rates of exchange, the nation can look to nuclear energy for 45 percent of its electricity by the end of the next decade.

Where do we stand today? What are the prospects for the future? In a special section, *Think* explores the promise of nuclear power. How does it fit into the context of oil shortages and coal abundance? How do reactors work, and where will the U.S. find enough uranium to power them?

Central to nuclear power, its history and its future, is the computer, starting with Dr. John von Neumann, the renowned mathematician, and continuing with the nationwide efforts of the Atomic Energy Commission. "Reactors probably wouldn't exist if it weren't for the computer," says one AEC official. Today, at two dozen independent facilities under its jurisdiction, the AEC relies heavily on computers for reactor research and other applications.

But nuclear power is not without its critics. Two outside authorities present the pros and cons.

In recent years, science and technology have come under heavy attack as a source of many of society's woes. Jerome Wiesner, M.I.T. president and former science advisor to President John F. Kennedy, offers a balanced approach toward putting science and technology in perspective. Not only scientists and engineers, but the practitioners of many disciplines, he maintains, have to be on the lookout for technology's

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unexpected side effects. Most of the world's problems, he says, "will require a substantial dose of innovative technology. But the technology can only be effective if it is created in the context of a realistic understanding of the need and a careful assessment of its impact." Wiesner's "prescription" for the next few decades includes a broad-based approach to engineering education, the capability of evaluating alternative technologies, and a means of communicating those choices.

THE MARKETPLACE

Twin Cities West 44

What's it like to be a branch manager in one of the fastest growing parts of IBM? A day with Bill Young, 31, branch manager of the Office Products Division's Twin Cities West office in Minneapolis, offers some insights into the style of a vigorous branch, running hard. Young's philosophy: "Keep your people happy and make quota. In that order." The statement rings true during the reality of Young's day-to-day work, as he tackles the scores of details, problems, challenges that keep Twin Cities West humming.

THE INDUSTRY

Putting a curb on computer frauds 46

Computer fraud is taking its place on the police blotter these days along with more conventional types of crime. No one can get a precise fix on the number of computer-related crimes because many of them—for one reason or another—never come to light. But, in a report titled *Computer Abuse,* Donn B. Parker of the Stanford Research Institute studies a dozen cases of bank fraud and embezzlement in which the computer was used. The average heist: $1-million.

As white-collar thieves are making the computer an accessory to their crimes, IBM is working hard to keep one step ahead by improving procedures for data security—inside the company and for customers, as well. Says the Data Processing Division's Sam Albert, manager, consultants industry: "We're letting the accounting and auditing communities know that many problems *do* have answers now. We're also making it clear that IBM is committed to technological innovations in data security and to sharing what we learn."

MANAGEMENT VIEWPOINT

Why the antitrust laws should be reformed 56

In the third week of July, Senator Philip A. Hart's Subcommittee on Antitrust and Monopoly began looking into the computer industry and the role of IBM. It was the wrong time and the wrong circumstances, asserted IBM Vice President and General Counsel Nicholas deB. Katzenbach, leadoff witness in the current phase of the hearings.

With the Government's suit against IBM originally scheduled to go to trial October 7, following years of preparation by both sides, the Committee would be depriving itself of expert testimony, Katzenbach said. What's more, there would be attacks against the company which IBM could not properly rebut under the circumstances—and is, in fact, forbidden to do, under court order.

Katzenbach maintained that the work of the Committee would be more productive if directed to clarifying the basic objectives of the nation's philosophy of competition and the mechanisms of its implementation. "Neither the Congress nor the Executive," he said, "has a clear, consistent, well-thought-out philosophy with respect to laws governing competition."

NOTES

The first Thomas J. Watson, Sr., Professor of Science at Brown University is Dr. Leon N. Cooper, a physicist who shared the 1972 Nobel Prize for Physics.

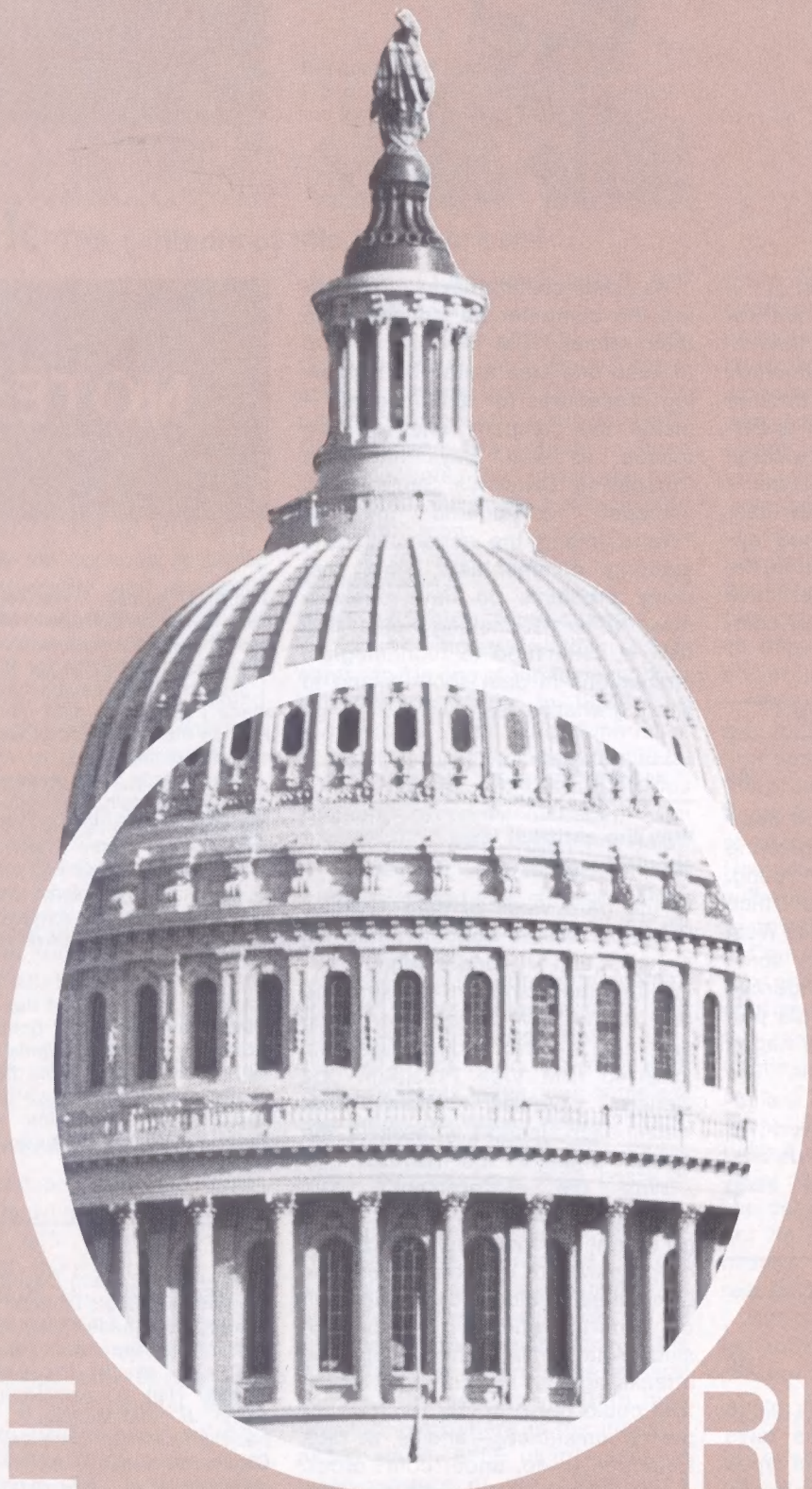
The recently established chair was made possible by a $1-million gift from IBM on the retirement of Thomas J. Watson, Jr., as chairman.

Tom Watson, Jr., a member of the class of 1937 at Brown, has been active in the university's affairs, serving as trustee, and a fellow of the Brown Corporation. Most recently, he served as chairman of a committee of plans and resources which conducted an extensive three-year study on the future development of the university.

Dr. Cooper shared the Nobel Prize with Dr. J. Bardeen of the University of Illinois and Dr. J. R. Schrieffer of the University of Pennsylvania for developing a new theory in the field of superconductivity—an almost complete disappearance of electrical resistance in various metals at temperatures near absolute zero.

At 4:18 p.m. Eastern Daylight Time July 20, 1969, the Eagle landed. The Eagle, of course, was Apollo 11, which carried the first men to the moon. This July 16, at 9:32 a.m., exactly five years after the launch, Neil A. Armstrong, Edwin E. Aldrin, Jr., and Michael A. Collins went back to Launch Complex 39 at Cape Canaveral, Fla., to commemorate the anniversary of their world-captivating adventure. During the nostalgic ceremony, the three Apollo astronauts—all civilians now—unveiled a plaque marking the take-off site as an Historic National Landmark.

Representing IBM was John B. Jackson, IBM vice president and president of the Federal Systems Division, which marshalled thousands of IBMers and tons of complex computer equipment to assist NASA in the pinpoint landing and the two-and-a-half-hour exploration of the moon.



THE RIGINS AND INTENT OF ANTI

A distinguished law professor reviews the legislative and judicial history. He examines the original Telex decision, now under appeal, and concludes that it was wrong.

by Eugene V. Rostow
Sterling Professor of Law
Yale University

On the following pages, Prof. Eugene V. Rostow, an authority on antitrust law, takes a detailed look at the history, intent, development, and court interpretation of the most important of the antitrust laws, the Sherman Act.

It is a topic of considerable importance to IBMers, for the company, says Rostow, "is now enduring an epidemic of litigation under Section 2 of the Sherman Act."

That is hardly an overstatement, and can partly be explained by the fact that many of the antitrust suits are the result of a bandwagon or follow-the-leader effect among IBM competitors.

The oldest suit, filed in January 1969, is the Justice Department's. It was scheduled to go to trial October 7 of this year, but was postponed until after December 2 at the request of the Justice Department.

In a suit brought by the Greyhound Corporation later in 1969 and tried in 1972, the verdict was a decision for IBM. It has been appealed by the plaintiff, and the Ninth Circuit Court of Appeals will probably decide the appeal this year.

The Telex Corporation suit, which Rostow examines in considerable detail, was tried last year and resulted in a setback for IBM. It, too, has been appealed. A decision is expected in the fall.

Unlikely to reach trial this year are five additional antitrust suits filed last year in the wake of the Telex decision. The suits are by Transamerica Leasing Corporation, Hudson General Computer Corporation, Marshall Industries, Memorex Corporation, and the California Computer Products Corporation.

An almost instinctive concern for the dangers of excessive power is the central theme of American public life. All our social arrangements derive from the same premise —the conviction that a person can be free, and that people can be equal, only in a society of pluralism, where power is dispersed, and the boundaries of power are established and maintained by law. As Tocqueville observed nearly 140 years ago, the assurance of equal personal liberty is the first goal of public order in America, a goal tenaciously valued as an end in itself, not a means to an end.

One sees the pattern everywhere.

The national government is one of limited powers. And the division of authority between the states and the nation is still a reality, although the balance has shifted in favor of the national government in recent years. Each governmental unit is organized in accordance with the principle of the separation of powers. The purpose served by that principle, as Justice Louis D. Brandeis once remarked, is not efficiency in government, but a state of tension maintained by the inevitable friction of the parts, a safeguard against tyranny, and the safest and most favorable setting for a system of individual liberty.

The same preoccupation with the problem of power is evident in our economic system. After our early experience with the Bank of the United States, the fear of the money power is so deep in the American political psyche that we had no central bank until 1913. Even now, the Federal Reserve System is a loose coalition of regional central banks, and its authority is qualified and limited. The great banks of New York can have branches in Tokyo, London, or Sydney, but not in Chicago, Houston, or Los Angeles—or, indeed, even in Albany or Buffalo. Our commitment to capitalism, as the basic rule for organizing economic activity through free and competitive markets, rests in the end on the same idea. The private ownership of property, and private initiative, are accepted not primarily on grounds of natural law, ideological commitment, or economic efficiency, but as an indispensable part of the strategy of freedom. Only an open capitalist economy can assure a wide diffusion of economic power, and equal opportunity for those who seek to climb the economic ladder.

TRUST LAW

The antitrust laws should be seen in the perspective of this concern about power. The first and most important of the antitrust laws, the Sherman Act, was passed in 1890 by a vote of both parties, in response to a social development which had alarmed the nation.

During and after the Civil War, technology and human energy transformed the face of America. The railroads consolidated the victory of the North. New industries, and old industries on a new scale, surged forward. The economy began to grow at an impressive rate. The United States, like Great Britain and Germany, began to take on the familiar features of modern industrial society.

It was a titanic achievement. And it bred titanic problems.

The vigorous and enterprising business leaders of the day, supremely confident in themselves and in their ideology, put empires together. In many fields, their companies achieved monopoly power, or something close to it. The barons of the railroad industry in particular seemed to threaten the country with combinations too vast and too ominous to be tolerated, holding the power of life and death over people, regions, and industries. Other industries were not far behind.

While the trust device was rarely used as the legal form of such combinations, the word *trust* took on a new meaning, which has survived to this day. Whether the monopolies of the era were formed by merger, or holding company, or otherwise, they were known as the "Oil Trust," the "Steel Trust," the "Whiskey Trust," the "Powder Trust," and so on. Tactics of coercion were freely used in building up these companies. Discriminatory advantages were obtained in transport costs and other facilities. Indeed, in one famous case, competitors were forced to pay a tithe to the dominant company in their industry on every sale they made.

"Populism" was the battle cry of those who opposed the tide: the democratic control of power; small business against big; the country at large against "alien" New York. Organizations of farmers and laborers were heard for the first time in American politics. Along with other groups, and other leaders, they sought the protection of national legislation against what all perceived to be the threat of concentrated economic power, marshalled by great New York bankers, and spreading its tentacles into every corner of the land. To control the new national economy, we had to invoke the national power over interstate and foreign commerce.

Many opposed the demand for legislative relief. True believers in the survival of the fittest, these people thought it unfair and unsporting to turn on the men who had won the race of competition. Justice Oliver Wendell Holmes, a stout Darwinian, was convinced that the Sherman Act was a humbug based on economic ignorance. Natural forces, he was sure, would soon erode temporary positions of monopoly.

The vast majority was unimpressed by the metaphor of sport. They thought that there should indeed be limits to victory in the economic race. What was at stake—the risk of oligarchy or tyranny—was too serious to be left to the market alone.

The Sherman Act initiated a process . . . which has made its ideas a powerful influence in . . . law and social outlook.

The reaction of American politics and American law to the alarms of the period took two characteristic forms: the Sherman Act, declaring rules of the game to preserve the competitive character of free markets; and the Interstate Commerce Act of 1887, establishing our first administrative agency to regulate the railroads, which were deemed to be a natural and inevitable monopoly, and therefore to require continuous governmental supervision.

Both the Sherman Act and the Interstate Commerce Act

Antitrust abroad? The Common Market takes a look

The European Economic Community has announced it will begin a formal investigation of possible violations by IBM of EEC's rules of competition, following a preliminary inquiry which began last December.

The EEC, more widely known as the Common Market, is a nine-member union of Western European countries set up in 1957 to remove trade barriers between member nations and form a single commercial policy toward other countries. Its founding treaty forbids abuse by one or more companies of a

have had long histories of development. The Sherman Act initiated a process of litigation, statutory change, and public education which has made its ideas a powerful influence in many branches of our law and social outlook.

The Interstate Commerce Act and the Interstate Commerce Commission it established also have had a far-reaching impact on the pattern of American industrial organization, and of thought about it. They provide the model for state and national regulatory systems controlling public utilities of all kinds.

The Sherman Act contains two essential provisions, which have not been changed in substance since the Act was passed. Section 1 of the Act declares illegal every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of interstate or foreign trade or commerce; and Section 2 provides that every person who shall monopolize, or attempt to monopolize, or combine or conspire with other persons to monopolize any part of interstate or foreign trade or commerce shall be deemed guilty of a misdemeanor.

The words in the statute reach back to the Middle Ages and beyond. But the Sherman Act gave the old words a new thrust, drawn, the courts said, from the conditions Congress was trying to correct. And it established new and practical remedies for behavior hitherto difficult to affect by law. Apart from its criminal procedures—which are used occasionally in cases deemed particularly offensive—the Sherman Act authorizes civil proceedings both by the government and by private litigants.

In antitrust cases, the government normally relies on the equity tradition in our court system, which allows the courts great flexibility in ordering defendants to do or not to do whatever they deem necessary in order to bring about conditions in conformity to the law. In extreme cases, the courts can even appoint receivers to carry out their decrees—through the sale of property, for example.

. . . 'bigness' does not violate the antitrust laws unless it carries with it a degree of monopoly power in a market.

Private antitrust litigation is confined largely to suits for damages by those who claim they have been injured as a result of violations of the antitrust laws. Such plaintiffs are allowed to recover three times the amount of the damages they have sustained, and a reasonable attorney's fee.

dominant position within the Common Market.

Albert Borschette, head of the Common Market's Competition Directorate, has said that initial inquiry has disclosed "certain facts" indicating possible violations of EEC rules, though he has declined to spell out what the facts might be.

In response, IBM Chairman Frank T. Cary commented: "With all the public statements and publicity surrounding antitrust activity in the United States, we understand why the commission would take this step. We believe that the inquiry will be fair and will confirm that IBM is in strict compliance with the rules of the EEC treaty."

The Common Market's interest in IBM, Borschette commented, was aroused by the Telex suit against IBM in which a U.S. judge ruled last September that IBM had monopolized the market for peripheral devices for its computers. In the same suit, it was also decided that Telex had stolen IBM trade secrets. Appeals by both sides are pending.

If the EEC Commission finds a dominant position has been abused, IBM can make an appeal to the European Court of Justice in Luxembourg. The court, a nine-member body somewhat like the U.S. Supreme Court, gives final rulings on all legal questions falling within the scope of the Treaty of Rome, the founding treaty of the Common Market.

The Common Market's rules of competition bear both similarities and important differences from U.S. antitrust laws. Article 85 is similar to Section I of the Sherman Antitrust Act in that it bans agreements or practices between competitors that restrict trade. However, certain agreements that might be considered violations of Section I of the Sherman Act may be exempted under Article 85 if they are found to stimulate the general economy and strengthen the position of EEC members.

Under Article 86, it is considered unlawful for business concerns to abuse a dominant position in the Common Market just as Section 2 of the Sherman Act condemns monopolization or attempts to monopolize. However, U.S. and Common Market standards differ. A competitive position viewed as "dominant" by an EEC tribunal might fall short of being considered "monopolistic" by a U.S. court.

EEC policy, under certain circumstances, encourages mergers or consolidations that strengthen the position of the Common Market or member countries. For example, the EEC Commission has encouraged the consolidation of the European computer industry by the adoption of preferential government procurement policies within Common Market countries. It has also encouraged European computer companies to strengthen their position by finding partners in Europe or outside. Other steps include the promotion of joint contracts between computer companies for research, encouraging the development of transferable software and promoting common data processing standards.

The six original members of the Common Market were Belgium, France, Italy, Luxembourg, the Netherlands, and West Germany. They were joined in 1973 by the United Kingdom, Denmark, and Ireland. IBM employs 72,000 people and operates nine DP manufacturing plants and four development laboratories within the Common Market. The company has done business since 1935 within all the countries that now make up the Common Market. ■

While styles have naturally changed from time to time since 1890, both in interpreting and in enforcing the antitrust laws, there has been a surprising degree of continuity in their development.

The first and most important feature of that continuity is the way in which the judges define their task under the antitrust laws. Eighty years ago, William Howard Taft, who was then a lower court Federal judge, wrote a classic antitrust opinion which, save in minor detail, could have been written yesterday. While there has been a long and inconclusive debate about many aspects of the antitrust laws, and new problems emerge every year, the central issues were settled early in the day.

The judges' job in applying the antitrust laws, Judge Taft and most of his successors have said, is not to decide whether the trust before them is "good" or "bad," in terms of some more or less tangible standard of economic performance, but to determine whether the defendants are "unduly" restraining competitive conditions in an economically definable market. The phrase "restraint of trade or commerce" means "restraint of competition," and monopolization is simply "restraint of competition" carried to its ultimate limit.

The statute seems to condemn "every" restraint of competition. Congress could not have meant this literally, since even the merger of, say, small grocers involves the elimination of some competition. Therefore the Act applies only when the elimination of competition accomplished by the restraint is substantial—quantitatively significant. This is the essence of the famous "rule of reason."

This way of interpreting the Sherman Act has far-reaching implications. It means, for example, that "bigness" does not violate the antitrust laws unless it carries with it a degree of monopoly power in a market. It means also that it is not a defense under the antitrust laws to contend that the defendant is a progressive, civic-minded, well-managed company supporting the Community Chest.

The focus of the antitrust laws is the state of competition in a market, and their principal goal—perhaps their only goal—is to prevent significant private interference with the competitive potential of that market. The premise Congress had in mind, the courts have said, is that if such private restraints are prevented or undone, society can rely on market forces to achieve an economically efficient level of prices and output, and a sound allocation of its scarce resources of capital, entrepreneurship, and labor. Equally, society can rely on the impersonal decisions of competitive markets to maintain a decentralized pattern of economic power, and an economy in which opportunity is open to talent and ambition.

In any event, the judges said, they cannot and will not try to decide whether a trust is behaving well. Such issues should be left to the arbitrament of competitive markets. The courts are not utility commissions. They cannot keep industries under continuous control.

This approach to the problem of interpreting the antitrust laws is largely, but not entirely, economic in character. There is still room in the law for the set of mind which prefers small business to big, and gives some weight to the notion that the law is directed against the abuse of monopoly power, rather than monopolization itself; against competitive behavior that seems "unfair" or "unethical" to judge or jury; against furtive or coercive behavior, or behavior intended to drive a rival out of the field. Usually, however, evidence of this color is mentioned to confirm or supplement the economic determinations which are supposed to be fundamental in each antitrust case: (1) "What is the market affected by the defendant's behavior?" (2) "Is that behavior a restraint of competition?" (3) "If so, does the restraint affect competition in the market enough to constitute a violation of Sections 1 or 2 of the Sherman Act, or of the Clayton Act?"

One of the consequences of this basically economic approach to the antitrust laws is that it clearly defines the relationship between Sections 1 and 2 of the Sherman Act, and the several provisions of the Clayton Act, which was passed during the first Wilson administration in 1914. While different words are used in the statutes, they all derive from the same idea, that of competition and its antonym, monopoly.

It follows, therefore, that the distinction among the offenses defined by the statutes turns on the amount of competition in a given market affected by the conduct under review. "Monopolization" under Section 2 of the Sherman Act requires a showing that the defendant or defendants have nearly complete control over prices, output, and the entry of rivals in the market. Evidence of control over supply is usually taken as a way of measuring that control. In monopolization cases, it is normally necessary to show that the defendant or defendants control a very large part of the supply in a given market—perhaps as much as 80 percent. Section 1 of the Sherman Act, which is addressed to "restraints of trade and commerce," requires a lesser degree of power over supply in the market—20 percent, 30 percent, or 40 percent, depending upon the dynamics of the market. The Clayton Act prohibits mergers, tying clauses, or price discrimination where their effect *may be* substantially to lessen competition in any market. This test, clearly, can be met by proof of less actual power to limit competition than is necessary to demonstrate a violation of either of the other statutory provisions.

Over the years, these tests have been applied to a great variety of practices, and in a great variety of business situations—to problems of large and small business, in local, national, and international markets. Very few lawyers or economists would now agree with Justice

Holmes that the antitrust laws are a humbug, and should be repealed. And all would agree that there is a considerable body of decisions which can be accepted as sound and well-established.

Very few lawyers or economists would now agree with Justice Holmes that the antitrust laws are a humbug . . .

For example, it was decided early, and has since been decided consistently, that agreements among competitors in a market to fix the prices at which they sell violates Section 1 of the Sherman Act. Such agreements, the courts have said, are "undue limitations on competitive conditions" in themselves, and are "conclusively presumed" to be unreasonable. In order to come within this rule, nearly all the cases agree, the defendants should control a substantial share of the supply in the market, although not necessarily enough to constitute a "monopoly." Without such market power, an agreement to fix prices would not make practical sense.

The rule against price fixing extends also to "price stabilizing," at least where the defendants have enough power to make success in their effort likely. And the same reasoning which has led the courts to adopt a "conclusive presumption" that price fixing is illegal has persuaded them also to strike down boycotts and group refusals to deal. Here again, the courts agree, the practice can have no legitimate business purpose. It is nothing more than an artificial barrier to entry into the market, or an artificial handicap to competitive success. If such a device is backed by enough market power, its effect must be to limit competition.

Agreements of market division raise similar problems. If substantial competitors allocate territories to each

(Continued on page 61)

Eugene V. Rostow, Sterling Professor of Law at Yale Law School, has specialized in the use of law and economics in the study of public policy. His major book in this field is *Planning for Freedom, the Public Law of American Capitalism.* Prof. Rostow was dean of Yale Law School for 10 years, later served the Government as Undersecretary of State.

Oryx

It's a Danish Longhorn

Everybody knows what a Longhorn is. Every American, that is. It's a breed of cattle so characteristically Texan that it lent its name to the development, in Austin, of the new IBM Memory Typewriter, before its official announcement last March.

But in Denmark, the Longhorn is quite a different creature: It's the African oryx antelope—a big attraction at the Copenhagen Zoo—whose horns grow to four feet in length and which is becoming as rare as it is beautiful.

To the Office Products group in IBM Denmark, it seemed a good idea in promoting the new typewriter to adopt the oryx as its namesake.

During a brief ceremony held at the zoo, and attended by 175 IBMers, Danish General Manager V. Troels-Smith and OP Manager Jorn Meldgaard, presented the manager of the zoo, Arne Dyhrberg, with an adoption check for the three oryxes there.

In so doing, IBM joined a number of Danish business firms which help support the garden. The zoo would like to produce enough of the vanishing oryx to supply to other zoos around the world.

The birth of two calves, born subsequently, has been celebrated with a birthday check from IBM.

The babies will be known as—what else?—"Memory" and "Longhorn." ■

He left his legacy in the IBM World Trade Corporation

The only real road to an internationalized business is people—people who think internationally—people who have mastered some of the languages and some of the cultures—people who can move freely and effectively from Paris to London, from Madrid to New York and back again, and do a professional job in each of these places . . . We want to find the way to take national labels off of our business and off of ourselves. We want IBM*ers to be at home anywhere in the world.*

—Arthur K. Watson
DP Hundred Percent Club
London
March 12, 1964

Arthur K. Watson himself personified the international IBMer he spoke about so often. When he died in July at age 55, after an accident in his New Canaan, Conn., home, he left a legacy of internationalism that blossomed during 21 years of leadership in the IBM World Trade Corporation and concluded with two years of distinguished service as U.S. Ambassador to France.

In 1922, Thomas J. Watson, Sr., took his younger son to Europe, and Dick—a nickname given him before he left the crib because it was one of the first words he spoke—watched his father set up a fledgling IBM operation abroad. It was the start of a lifelong love affair that gave substance to the "I" in IBM.

"More than any other man, except for my father," says Thomas J. Watson, Jr., "Dick was responsible for developing IBM as an international business. He not only built an outstanding organization around the world, he also pioneered within IBM in developing the kind of international executives we need to run the business."

When A. K. Watson joined the IBM World Trade Corporation upon its formation in 1949, IBM sales outside the U.S. were less than $50-million. When he left in 1970 to become ambassador, World Trade sales had topped $2.5-billion. The organization had grown from 9,700 people to 100,000. And, for the first time, net income from IBM operations in 108 countries equaled that of IBM in the U.S.

Viewed in perspective, Watson's entire life was a preparation for his internationalist role, which was cited in eulogies on the floor of the Senate by Senators Charles H. Percy and Jacob K. Javits.

He went to Hotchkiss School, where he showed a knack for languages. When he joined IBM, he spoke fluent French, and for the first five years of his business career, he spent more than an hour a day to master Spanish and German and to develop a working knowledge of Portuguese.

At Yale, he majored in international affairs. In his senior year (Class of '42), his studies were interrupted by the war. He applied for European duty but was assigned to the Ordnance Corps in Aberdeen, Md., as an instructor. Near the end of the war, he was sent to the Philippines and eventually discharged as a major. He asked his father if he could stay on as an IBM representative, but the elder Watson called him back to the States, where he received his B.A. from Yale and joined IBM.

After graduation from Sales Class 725, Dick Watson took a territory in New York City's financial district and made his first Hundred Percent Club—in four months—with 137 percent of quota. The next year, he made 298 percent.

In 1948, Tom Watson Sr., took a team of IBM executives to Europe on what turned out to be a very important business trip. At the time, IBM was assessing the postwar situation in each country and developing a plan for expanding the business there. Watson's choice as assistant and translator: his son, Dick.

Recalls Albert L. Williams, one of the executives on the trip and a former IBM president: "Dick Watson had a very highly developed sensitivity to the feelings of the people. He seemed to know what made people of other nationalities tick. He was international in his thinking. Later, of course, he became a loud, clear voice in IBM management for the importance of markets around the world."

War on drugs

When he arrived in Paris, the first act of the new U.S. Ambassador was to join forces with the French to stop the heroin flow.

He called it the "proudest accomplishment of my life." Arthur Watson was talking about his efforts to cut off drug traffic from France to the United States. When he arrived in Paris as U.S. Ambassador in early 1970, heroin was flowing at record levels out of the Marseilles area.

One of his first acts in Paris was to spur a joint U.S.-French effort to stop the drug traffic. With allies in the French government, he fought for and won substantial increases in both the French and U.S. overseas narcotic forces. When he arrived, the French had 32 drug police; the Americans, 17—in all of Europe. By the time he left, the French had 170 men in the field; the Americans, 39. Poorly equipped at the start, the Marseilles police were the best equipped when he left, Watson not only worked closely with the French police, but he also enlisted the aid of the U.S. Army in aerial surveillance over the Mediterranean, engaged the Sixth Fleet in a search for smugglers at sea, and called on the Central Intelligence Agency—as well as a dozen other American agencies—for assistance.

Heroin seizures in Marseilles increased five times. By July 1972, there was a drug panic in New York. Because of a widespread shortage, the price of what little heroin was available had tripled. An estimated third of the French drug traffickers were in jail; perhaps another third had stopped their dealings; and the rest were operating with extreme caution.

One result of the trip was the formation in 1949 of the IBM World Trade Corporation. Another was the appointment of Dick Watson as a vice president and director of World Trade. "Dad was feeling me out," the younger Watson once recalled of the 1948 trip. He described his reaction on the day of his appointment: "That was a great day. I can't remember when I didn't want to get into the international end of the business."

Four years later, Watson was elected president of IBM World Trade. In 1963, he became World Trade board chairman; in 1964, IBM senior vice president; and, in 1966, vice chairman of the IBM board of directors. Along the way, he put IBM's overseas operation on the corporate map.

When he took the World Trade vice president's post in 1949, the business outlook was gloomy. In France, for example, inflation was rampant and the currency almost valueless. Watson solved the problem by importing money from Holland and Argentina.

Throughout the postwar period, he had a theory: If IBM did business in enough countries, the company would be able to make a profit because enough countries would be healthy at the same time, even if some had political or economic crises.

During the first 10 years of World Trade, Watson was out of the U.S. seven months of the year—most often accompanied by members of his family—as the company's ambassador-at-large. In India, for example, he negotiated with Prime Minister Nehru and eventually persuaded him that IBM was good for the country. The result was a plant in Bombay. In Argentina, he engineered the financing of IBM headquarters with frozen funds. In Spain, where the company also had trouble exporting its money, Watson worked out a complicated arrangement that benefited both Spain and IBM.

As IBM Senior Vice President Jacques G. Maisonrouge, now president of IBM World Trade Europe/Middle East/Africa Corporation, once said of Watson: "One of the greatest qualities Dick has is his empathy for other cultures. He is at ease in any country he goes to."

So at ease, in fact, that he delighted World Trade audiences by speaking their language and often their dialects, using Mexican Spanish in Mexico, for example, rather than Castilian Spanish. In his travels, he met with country presidents, premiers, and cabinet ministers and became acquainted with the principal people behind the European Common Market, which he backed early and vigorously as a stimulant to international trade.

Watson soon became an effective spokesman for business in general and for his country—a proponent of international trade as a path to worldwide peace and prosperity. In 1963, President John F. Kennedy appointed him to a 13-man task force to consider how to promote more foreign investment in U.S. securities, and to study whether the overseas operations in American companies could raise more funds abroad. In 1965, Watson became head of a 14-member advisory committee formed to make evaluations and recommendations on private enterprise in foreign aid. The committee reported its findings to President Lyndon B. Johnson, and a majority of them were eventually adopted by the Agency for International Development. During 1969, Watson accompanied then New York Governor Nelson A. Rockefeller to Latin America as part of a study commissioned by President Richard M. Nixon to improve U.S. policies toward other American nations.

As president of the International Chamber of Commerce from 1967 to 1969, Watson enlarged its role as a force to liberalize trade around the world, while he himself fought "protectionism" at home. With David Rockefeller, he formed the Emergency Committee for American Trade, which mustered Congressional support to fight off trade restraints advocated by some industries.

He extended his business philosophy to East European countries as well. Earlier in his career, at a Moscow trade fair, he persuaded Nikita S. Khrushchev to watch a demonstration on the latest IBM equipment. Back in 1960, long before it was widely accepted, he called for admission of the People's Republic of China to the United Nations and a complete overhaul in U.S. policy toward China. Later, as U.S.Ambassador to France, he became his country's first liaison with the People's Republic of China through their then Ambassador to France, Huang Chen. The two men became good friends, and when Ambassador Chen was assigned to the U.S. they exchanged visits. Recently, Watson and his family went to China as official guests.

The six-foot-two-inch executive, brown-eyed and silver-haired, was known to his friends as super-affable. He liked to ski at his vacation home near Stowe, Vt.; fly whenever he got the chance; and sail his 48-foot sloop from his summer house in Camden, Maine. He also enjoyed cooking for his wife, Nancy, and their children—Ann Carroll, Jane White, Caroline Trowbridge, Arthur Kittredge, Stuart Hemingway, and David John.

Upon his return from France in 1972, Watson was reelected to IBM's board of directors and its executive committee. He also formed Partnership Dankist, a venture capital firm located in Stamford, Conn.

On the corner of his desk in IBM, he kept a sign that read, simply: "Be best." In carrying his father's message of "world peace through world trade," he applied a healthy measure of energy and grace. He expressed his underlying philosophy at the International Chamber of Commerce Congress in Istanbul, Turkey, at the close of his term as president: "Providence was not whimsical when it chose business to bring the world together. People care about business. They may never agree about religion or ideology. But there is a logic to business, and, through it, we may see this quarrelsome, troubled world brought together." ■

Internationalist

In his first ten years with World Trade, Arthur K. Watson spent seven months each year traveling the globe, often with members of his family. No one knows exactly how many hundreds of thousand miles he covered as he set about building the company's operations in World Trade countries, all the time conveying his vision of business as the means to 'interweave our affairs as to make war unthinkable.' This picture album shows just a few of his stops.

Left: During the 1968 dedication of the new Office Products plant in Amsterdam, Prince Bernhard of the Netherlands, right, appointed World Trade Chairman Arthur K. Watson a Commander in the Order of Oranje Nassau. It was one of many honors given Watson over the years for his international achievements inside and outside the company.

Top right: Watson gave support to West Berlin during and after the Soviet blockade. Through his friendship with former West German Chancellor Willy Brandt, then mayor of the city, IBM built one of West Berlin's first major postwar buildings on Ernst-Reuter Platz. Here, he is at the 1962 opening of the new IBM office with Brandt, center, and Walter C. Dowling, left, then U.S. Ambassador to West Germany.

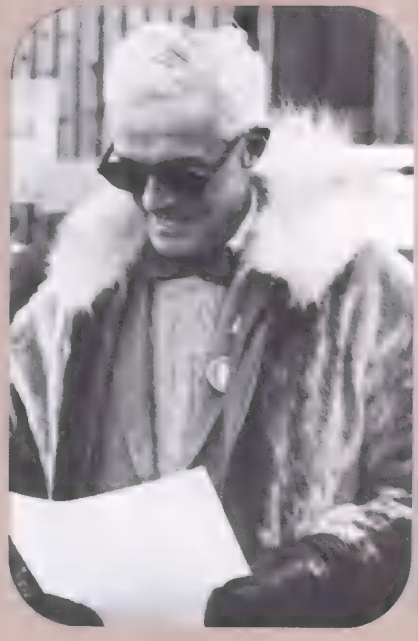
During his 21 years with World Trade, Watson spent much of his time abroad, setting up new country operations, selecting managers, and guiding expansion. In 1965, he visited the planned site of the Nordic Education Center near Stockholm.

For two years, Watson headed the International Chamber of Commerce and directed its efforts toward liberalizing international trade policies. "We believe that enterprise should be free, that trade should be free, and it will follow that people can prosper and be free," said Watson at the 1967 Montreal meeting where he was elected to succeed Dr. Marcus Wallenberg, right.

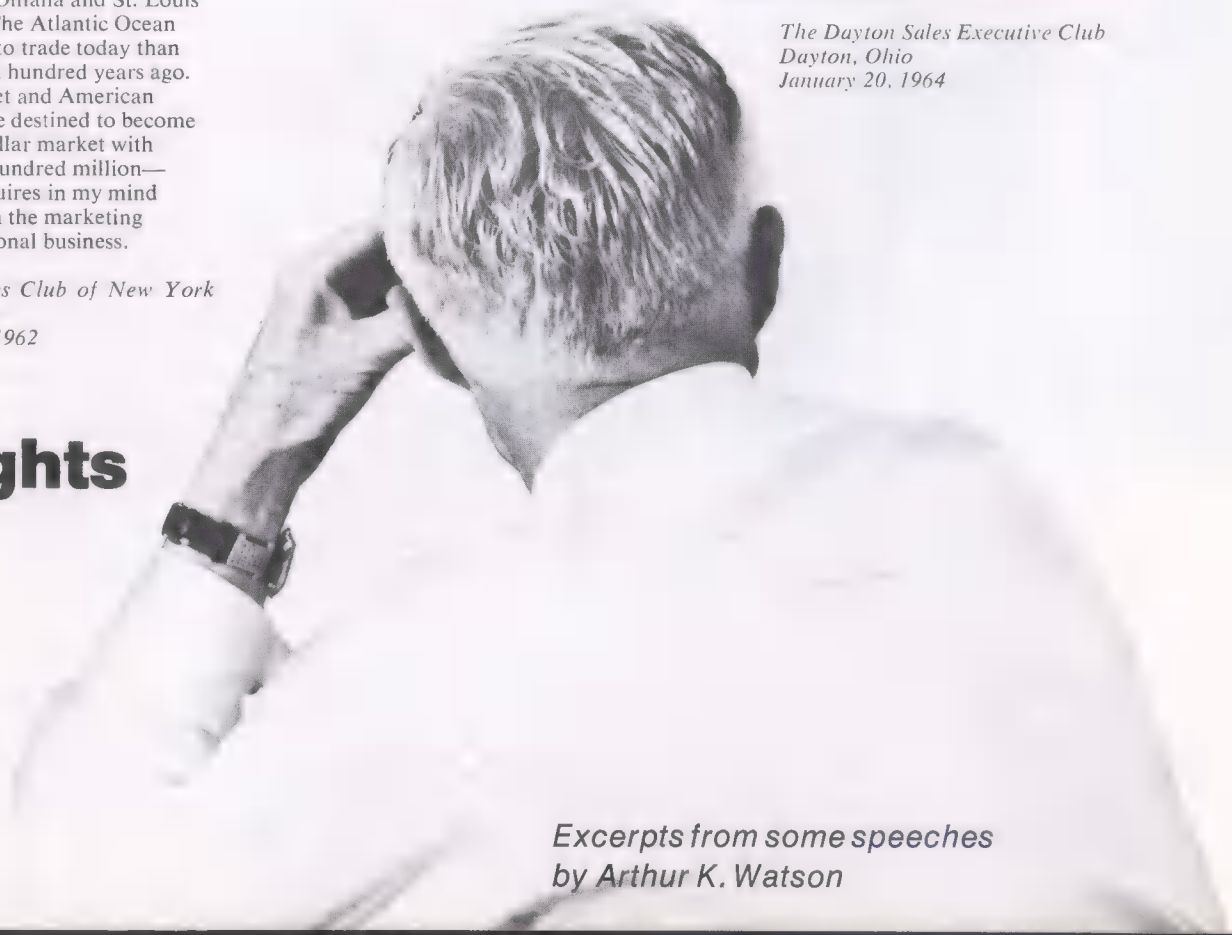
Above: Watson and David Rockefeller formed the Emergency Committee for American Trade, an organization joined by the heads of 60 of the largest U.S. corporations with the purpose of gaining support against protectionism. In 1968, Watson and fellow committee members met with Congressman Wilbur D. Mills, left, chairman of the House Ways and Means Committee, to urge passage of a new trade bill.

Below left: In the early Fifties, IBM Japan was just beginning on its growth curve toward leadership in the Far East. Watson's reputation as an international businessman had also started to grow. During the Far East/America Council Conference in 1953, he meets with Eikichi Araki, then Japanese Ambassador to the U.S.

Below: Known as an excellent skier, Watson took to the slopes of Grenoble, France, in 1968 for the 10th Olympic Winter Games. He scans results from some of the events printed out by IBM equipment, which verified and analyzed the data, then flashed back the information for announcement.



Thoughts



Excerpts from some speeches by Arthur K. Watson

I do not believe we will be permanently welcome anywhere unless national employees of our companies—be they British, Japanese, or American—can look forward to careers that will take them anywhere and as far and as fast as their talents permit. This kind of policy is simple justice—and good sense. It is also the only way to develop a real world constituency for international cooperation.

We must internationalize ownership. The nationalist attitude would today have us fractionate our great corporations and sell them piecemeal in each country. That is a backward step. The forward step is to internationalize ownership of the parent corporations, to trade their stocks on every major capital market in the free world.

Fiftieth National Foreign Trade Convention
New York City
November 18, 1963

Today London and Paris are really easier to reach than Omaha and St. Louis were back in 1862. The Atlantic Ocean is no more a barrier to trade today than the Mississippi was a hundred years ago. The Common Market and American market combined are destined to become by 1970 a trillion-dollar market with half a billion—five hundred million—consumers. This requires in my mind the continuing rise in the marketing function in international business.

Sales Executives Club of New York
New York City
September 11, 1962

I recall, several years ago, an evening I spent with the chief of a tribe in the Congo. He was an old man, and a wise one; and as we chatted through that hot, humid evening, he finally felt that he knew me well enough to ask the one question that was important to him.

"Tell me, Mr. Watson, why does your country impose its way of doing things on us? We have had chiefs for a thousand years in the Congo. Now you tell us that chiefs are no good, we must have a Parliament. Why?"

I mumbled an answer. It failed to convince him—or me—but the old chief was polite. He didn't press me. Instead he pointed a finger toward the north, toward Nigeria.

"Over there," he said, "they already have a Parliament, and the ministers wear wigs.

"Mr. Watson, did you ever wear a wig in this climate?"

Perhaps his point—certainly mine—is the familiar one of human understanding. We've become the talkers at international meetings. We expect to be heard. We expect to be followed. The time has come when we also must become listeners—we must remind ourselves that the talker educates but the listener learns—and there is much to learn.

Commencement Address
Georgetown University
Washington, D.C.
June 10, 1963

There is no time to go through the grim arithmetic of population and food production. All we know is that two lines may cross on a graph sometime in the 1970s. If they cross, it will mean that all the food that can be grown in the less developed world, plus all the surplus that can be created in the developed, will still not be enough to feed everybody. They can allocate wheat in Geneva, but they don't grow much there.

Nor can we console ourselves with the notion that hunger and economic development are government responsibilities. The needs of the developing countries are now well beyond what governments are willing to do to help. Either private enterprise finds a way to invest more billions of dollars in these countries or the way will not be sound.

21st Biennial Congress
International Chamber of Commerce
May 19, 1967

Our role in the free world depends on technological leadership. In the international markets, we are living on our wits and it is a competition that not only benefits us, it benefits the rest of the world as well.

As my father used to put it, if two men have one dollar each, and they trade dollars, they both still end up with only a dollar. But if they have one idea each, and they exchange their ideas, they both end up with two ideas.

The Dayton Sales Executive Club
Dayton, Ohio
January 20, 1964

I remember . . .

A longtime friend and associate of Dick Watson recalls some of the earlier days when World Trade was just getting started

by Jack Brent
Chairman of the Board, IBM *Canada Ltd.*

Six years ago. Dick Watson, his wife, Nancy, and their six children in a Christmas photo taken at their home in New Canaan, Conn.

I was one of the lucky ones who knew Dick almost at the outset of his IBM career. In September 1949, I was vice president and sales manager of our Canadian company when Dick telephoned me from New York and asked if he could come and see me. I'd only met him once before. He was 31, vice president and general manager of the newly formed World Trade Corporation, and exhibited an interest and energy he never lost. We bowled on the green on a Saturday morning and he asked a lot of questions. I didn't understand why until his father, T. J. Watson, Sr., called me to New York a few days later and asked me to take over the European business of the new subsidiary.

I knew little about the rest of the world and almost none of the people in IBM World Trade in Europe. Dick had already traveled widely and knew everybody.

Our problem was monumental. The big countries were still picking themselves up after the war. They had no American currency with which to buy our machines. We were obliged to make machines abroad for our customers abroad. But we lacked money, people, and facilities. There had been little or no business for IBM in Europe or the Middle East since before the war.

The only foreign currencies we had were in those countries that had stayed neutral during the war—Switzerland, Sweden, Spain, Argentina, for example. We had quite a few guilders in Holland that were held by the national bank but which were released to us to enable IBM to start a small manufacturing plant in the Netherlands.

Back in the States, the new accounting machine, the 407, was displacing a lot of 405s. Dick bought a lot of the replaced 405s for about $125 apiece on an "as is" basis. Some of the machines were as much as 15 years old. Dick worked with the French IBM general manager to set up a French development lab and refit those 405s with the newer wire contact relays, new printing mechanisms, and a calculating device especially needed by French and Italian banking. We were successful.

Our French company couldn't meet its payroll at the start so Dick agreed to let it rent machines for as much as five years rental in advance, at a discount, so that we could get money to pay the employees. Then Dick went all over the world trying to get money to pour into the European labs and plants. He called me once from Buenos Aires and reported that IBM had accumulated money there during the war and that he could swap some of the earnings for

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Jack Brent, Chairman of the Board, IBM *Canada Ltd., was World Trade Corporation vice president and general manager of Europe in 1949, the year the subsidiary was formed. During five years in Paris, and his next seven as vice president and general manager of* WTC *in New York, he and Dick Watson worked closely in helping build* IBM*'s international business.*

French francs. For some reason, Argentina had quite a lot of francs. All I had to do was promise to ship machines against the money he was sending. Next, he called from Japan and told me to ship machines there in exchange for yen that could be swapped for marks to help IBM Germany start manufacturing. I thought Japan would be prostrate for years, its yen worthless, but Dick told me it would be one of the strongest members of the IBM family in five years. He was right.

A Madrid banker came to Paris to say that Spain had acquired German marks during the war. He needed our machines. Would we accept the marks? One-third down on verbal agreement; one-third when the machines arrived; the other third after he had the machines for a year. We agreed and used the marks to help our German manufacturing effort. Dick and I thought of everything to use up IBM money in Spain that we couldn't get out. We held Hundred Percent Clubs in Spain. We did the printing and translation in Spain for all of Spanish-speaking Latin America—only to find that the Spanish language differed from country to country. They were difficult but exciting times, and somehow when I think of how Dick operated, I can only characterize those years as downright fun.

Dick was no absentee landlord. He lived summers in Paris with his family and spent a lot of time flying around the world the rest of the year.

He kept his father informed about our major activities, but there were a lot of shortcuts certainly—legal, but simply difficult to understand quickly enough back at headquarters—that Dick took on his own. In those days, you often had to wait a day to get a trans-Atlantic telephone call through, and sometimes there just wasn't time to wait.

He was a young man building a young business and there was never a better match.

We formed a committee made up of a number of nationalities to manufacture data processing products in Europe. For typewriters, too. In Europe, it was hard to buy an IBM typewriter without a special import permit. We had no way of making typewriters until Dick concentrated on that one. Again we had no manpower or money, and, in typewriters, no expertise. To avoid problems of customs, trade barriers, and national boundaries, we assigned the manufacture of different typewriter parts to different countries. Then everybody shipped the required parts to their neighbors, and each country eventually could put its own typewriters together. All 16-inch carriages. All one kind. The first annual production was 10,000 machines. They sold, and we were in business.

International teamwork is taken for granted today. Even so, there are always nationalistic feelings; animosities; strain. Imagine, then, what it was, shortly after the war, to ask Germans, Italians, Frenchmen, Belgians, Dutchmen, Englishmen, Norwegians, and Spaniards to work together.

I'm convinced no other man could have acted the catalyst as Dick Watson did. He spoke fluent French, was studying German and Spanish religiously. He made many speeches in French, and however limited his vocabulary in German and Spanish in the early years, he could *sound* like a German or Spaniard, for the simple reason that Dick was a natural mimic. He could relieve tension by imitating a person of any nationality giving a presentation of the issue that had us hung up.

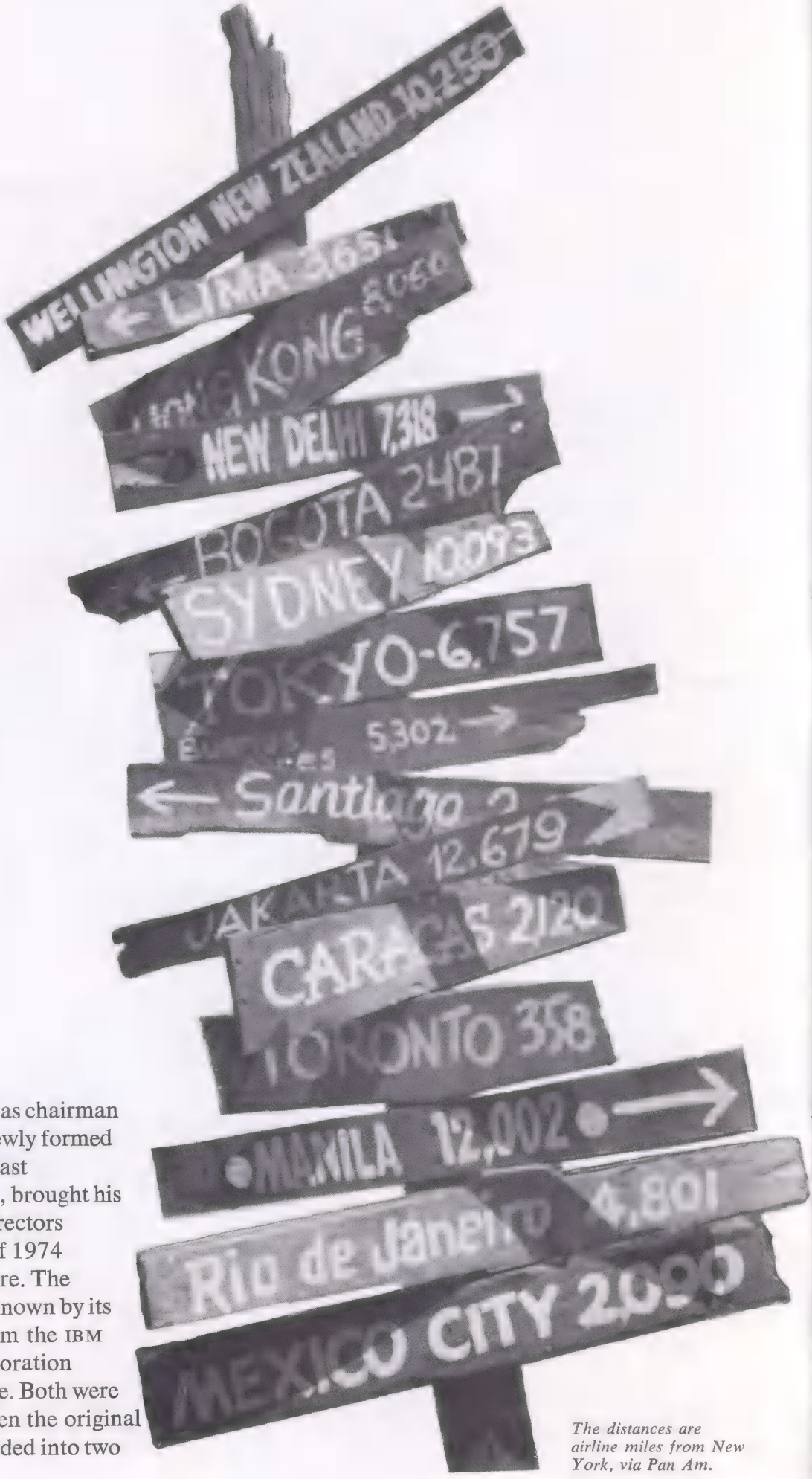
He could be funnier than any stand-up comedian. He reminded everyone that whatever his nationality, we were all committed to the same business and he literally joked away bad feelings when they arose.

Once, when we were having an international meeting of senior management in London, Dick averted a potentially explosive situation by suddenly inviting everyone out to Lock's the famous London hat maker, and buying everybody a hat. There must have been 50 of us, all proudly wearing Lock's hats. Dick could make a simple game like musical chairs into one of the most joyous evenings of your life.

We rode night trains out of Paris, after a day's work, to get to whatever was the next problem country. After dinner on the train, Dick might just suggest bridge. Dick was as talented at making us relax as he was at making us work hard. He had the perfect ear for sounds of life. How people talked. How music sounded. He could yodel delightfully, and sing with sensitivity. There was no American chauvinism in any of his actions or decisions or approaches. He had the confidence and affection of all the nationals he dealt with.

I think of his warmth and enthusiasm. How he could be impatient with stupidity, carelessness, or indifference. How he could be fair to anyone whose mistake resulted from trying hard to do right by the business. How he could drop everything if someone ran into a personal problem. The wife of the typewriter manager in Norway, I remember, had contracted polio. Dick got them over to the States where she could be treated, and found the means of keeping them there for two years during the period of treatment.

In retrospect, Dick's gestures of camaraderie were extremely important in unifying all the diversified personalities and nationalities into one loyal IBM team. It worked. And in working, it created quite a lasting monument to Dick Watson. ■



The distances are airline miles from New York, via Pan Am.

On the first day of his twelfth week as chairman and chief executive officer of the newly formed IBM World Trade Americas/Far East Corporation, Ralph A. Pfeiffer, Jr., brought his key overseas managers and staff directors together in Bermuda for a review of 1974 performance and plans for the future. The organization is already popularly known by its initials, A/FE, to distinguish it from the IBM Europe/Middle East/Africa Corporation headed by Jacques G. Maisonrouge. Both were formed on April 4 of this year when the original World Trade Corporation was divided into two new operating units.

On April 4 of this year, the world of IBM World Trade became two worlds when the companies in Europe, the Middle East, and Africa were brought together under one corporation headed by Jacques G. Maisonrouge, and—with the exception of the U.S.—those in the Americas and Far East were formed into another corporation under Ralph A. Pfeiffer, Jr.

Why the two new operating units? As IBM Chairman Frank T. Cary explained at the time: "No single management [and here he was referring to the old IBM World Trade Corporation] can ride herd day by day, in detail, on such a great and growing business."

And growing it has been. From 1950 through 1973, World Trade revenues had jumped from $51-million to more than $5-billion, a hundredfold increase in less than 25 years.

Employee population had grown from 8,000 to 122,000.

And World Trade was doing business in 126 countries, each with its own unique set of opportunities and problems.

Moreover, as Cary again pointed out, it was a global business that had become all the more difficult to manage, not only because of what he called "explosive growth," but because of "increasing competition, problems with economic nationalism, and marketplace demand."

For Jacques Maisonrouge, with 82 countries in his domain, the realignment means that he can now concentrate all of his energy and that of his Paris-headquartered staff on the highly developed marketplaces of Europe and the developing lands of the Middle East and Africa.

For Ralph Pfeiffer, until then president of the U.S. Data Processing Division, the changeover is equally—indeed, some might say even more—challenging.

For while there are similarities between the two areas, the differences are vast.

In contrast to the heavily industrialized land mass of Europe which accounts for the largest share of the revenues in Maisonrouge's corporation, the new Americas/Far East Corporation occupies a vast oceanic world. It reaches across almost three-quarters of the globe, all the way from the banks of Newfoundand and the Caribbean, across the wide Pacific and into the Indian Ocean.

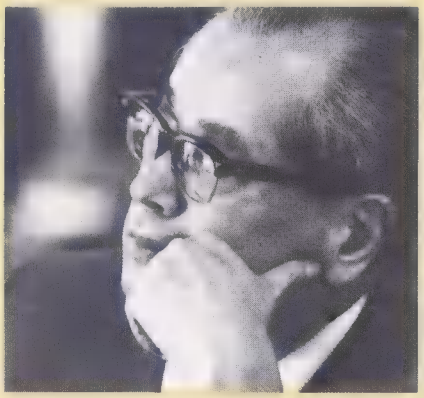
A/FE does business in 45 countries, spread across four continents—the North and South Americas (excluding the U.S.), Asia, Australia, and the huge subcontinent of India.

Excluding China—although for the longer term no one in A/FE is prepared to exclude anything at all—A/FE encompasses a marketplace of one and one-half billion people, all the way from the giant industrial centers of Japan and the booming cities of South America to the more remote nations of Southeast Asia.

It accounts for 36,000 employees, and the mixture is almost as diverse as that of the geography itself. Some are clearly products of the great changes taking place in that part of the world. The grandson of a village family once considered "untouchable" is a rising young executive of IBM India in New Delhi. And a Brazilian systems engi-

The new Americas/Far East Corporation covers three-quarters of the globe and it's one of the fastest growing parts of IBM

Some territory!



Sanae Inagaki
President, IBM *Japan*

Since 1950, the IBM Corporation's worldwide revenues have increased more than 41 times; worldwide employment, nine times.

During the 24 years Sanae Inagaki, now president of IBM Japan, has been with that company, revenues have increased 2,450 times in dollar terms, and the 66 employees of 1950 have increased to more than 10,000.

And, in a land where electronics is the largest growth industry of them all, Inagaki takes a special pride in the fact that when Japanese students were asked which company they would like most to work for, IBM came out on top.

He takes equal pride in the leading edge applications for which IBM Japan is best known—the NHK system for operation and management of that country's national television network, a highly sophisticated system for integrated steel production, and another for newspaper makeup.

Where is IBM Japan going? Inagaki smiles and points his finger. Up. Not only in sales, but in production. The company now has two computer plants and a development lab of its own.

Allan G. Moyes
Regional Manager, Australia-New Zealand Region
Managing Director, IBM *Australia*

The "down under country" of Australia is very much on the way up. Not only are its agricultural products and mineral resources in high demand, but Australia is very rapidly shedding its onetime empire economy to become an industrial and commercial power on its own.

Allan Moyes is characteristic of the new breed of Australian. A rangy, laconic, quiet-spoken Aussie, he was a civil servant for the central government before joining IBM in 1953. Now managing director of IBM Australia, he wears a second hat as regional manager for the Australia-New Zealand Region.

Though still primarily an agricultural producer, Australia has been developing an industrial self-sufficiency of its own in the Sydney-Melbourne corner of that island continent where 40 percent of its 13 million people live.

Revenues for IBM Australia have multiplied six times in the last ten years.

What about the world-famed opera house that has become an architectural landmark in the port of Sydney? "It started at 10 million Australian dollars," says Moyes, "and it cost $102-million. But it's a fantastic piece of architecture—worth every cent."

J. A. (Pepe) Guerra
General Manager, Latin American Area
Member, A/FE *Board of Directors*

Pepe Guerra—it's pronounced and ought to be spelled *peppy*—is the voluble, fast-talking, Spanish-accented general manager of the Latin American Area of A/FE. He takes in the whole piece—from the Mexican border on the Rio Grande to the tip of the Argentine.

The biggest IBM company in Latin America is Brazil where the economy has been expanding at more than 10 percent a year, despite a rate of inflation that this year reached 30 percent.

Guerra takes a proper pride in his new post. Onetime president of IBM Mexico, he had been assistant area general manager until his accession to the top post earlier this year.

"A couple of weeks ago," he explains, "I was calling on the president of Colombia and he was astonished to find a *latino* heading IBM for all of Latin America."

In his area, Guerra oversees the activities of 10,000 IBMers, including almost 1,900 in four Data Processing and Office Products plants.

neer, born at a trading post 1,200 miles up the Amazon, now works in IBM headquarters in Rio, almost within sight of the Copacabana beaches.

Of the 25 manufacturing plants in World Trade areas, A/FE, at this stage, already has 11, seven of them for data processing, including the unit record equipment plant in Bombay, and four for office products.

To firm up his new organization, Pfeiffer brought his area and regional managers, his principal country managers, and A/FE staff together for a sequestered week-long review and planning meeting in Bermuda. The meeting was on home ground; Bermuda is part of the North Caribbean region reporting to IBM Canada.

The objective of the meeting was made clear in the opening session, for as Pfeiffer pointed out, A/FE is one of the fastest-growing operating units in IBM and the intent is to keep it that way.

And, indeed, that intent was affirmed in a preliminary report on year-to-date results for 1974. Once again, on top of A/FE's robust rate of growth for 1973 (when it operated as a group within WTC), the corporation at mid-point this year has already scored great gains in all areas of the business.

Although the conference had been planned primarily to speed the start-up of the new corporation, it inevitably became a getting-to-know-you-better meeting between the overseas managers and the corporate staff. For many of them, it was a first face-to-face meeting, and for some of the overseas managers it marked their first meeting with Pfeiffer. Characteristically, he moved out in the first 45 days of his new assignment for get-acquainted meetings with his principal managers in Canada, Japan, and Brazil. But Bermuda enabled him to reach out, to include far-off country managers like Allan Moyes of Australia-New Zealand, Benito Esmerode of Argentina, and others.

At the time of his April announcement on the move to divide World Trade into two worlds, Cary had said: "The change means decentralization, a shortening of communications lines, and the pushing of decision-making as close as possible to the point of action."

By midday of the first Bermuda session, after four and one-half hours of viewgraphs, area and country managers had already made it clear how much

Lorne K. Lodge
President and chief executive officer
IBM *Canada*

Not the least of IBM Canada's challenges is persuading Canadians that the company's economic contributions are more important than the matter of U.S. ownership. With increasing public concern over foreign investment (as high as 75 percent in some industries), its contributions are often overlooked by the country's vocal economic nationalists: employment for 10,000 Canadians, three major plants, a 300-man development lab, and a major export program.

Lorne Lodge, 43, president and chief executive officer, is committed to maintaining the company's "Canadian identity." The Toronto-born executive says: "Our objective is to build a healthy IBM Canada, but we see that as completely consistent with building a healthy Canada."

In 1974, real GNP is expected to increase some five percent, giving Canada the fastest growth of any major industrialized nation. The country uses some 4,500 of the world's 100,000 computers, placing Canada second only to the U.S. in per capita installations. Over the past 10 years, revenues from office products have doubled, on the average, every three years. This year, for the first time, OP sales are expected to be the highest of any country outside the U.S.

Ralph A. Pfeiffer, Jr.
His territory straddles three-quarters of the globe and it is a world whose time has come.

they welcomed the move.

Of course, they agreed, it means that everything will be brought more clearly out into the open, with exacting targets on every element of the business.

"But," said Pepe Guerra, area general manager for Latin America and a member of the A/FE Board of Directors, "when World Trade was a single organization with more than a hundred country companies, there wasn't always enough management direction to go around, and we sometimes found ourselves taking a back seat to the larger companies in Europe. With A/FE, we're right in the thick of things and we can get decisions faster. When I have to, I can easily call Ralph and get a decision on the phone."

So, too, Tak Shiina, vice president of the corporate staff of IBM Japan and a chief lieutenant to Sanae Inagaki, president of that company. "The day A/FE was formed," he said, "IBM Japan went from a minority to a majority position in the World Trade organization. Earlier, when everyone reported to the same headquarters, we dragged along in revenues behind the Big Three in Europe. Now we're number one in the A/FE organization. Do we like it? You bet. We love it."

For almost three months prior to the meeting, the A/FE staff had been busy, getting organized, canvassing candidates to fill empty headquarters slots, reviewing and resetting what had been the area's group plan.

The task had been confounded by office problems. The nucleus of A/FE is centered in leased offices in a Port Chester, N. Y., shopping center. Other elements are scattered in seven remote locations, all the way from United Nations Plaza in New York City, upcountry to White Plains. This situation still exists. It will not be corrected until A/FE moves into a new headquarters structure of its own this winter in the suburban town of Mount Pleasant, near the Hudson.

Pfeiffer himself had worded the theme for the meeting. It had been lettered on an easel—*The Challenge of Opportunity*. And from there it stared at the participants all week.

Elsewhere in the company, the word *challenge* occasionally brings a grimace to some who think it a much overworked word in IBM. Or as a skeptic once said: "It's become a code word to mean either we don't know what to do, or how to do it."

Data by satellite

Computers have long played a key role in launching and operating satellites. Now satellites are expected to play an increasingly important role in computer data communications. To bring that day closer, IBM recently announced plans to join with the Communications Satellite Corporation (COMSAT) in the domestic satellite business. Subject to approval by the Federal Communications Commission, IBM will acquire 55 percent ownership in CML Satellite Corporation. COMSAT General Corporation, a COMSAT subsidiary, will increase its ownership from 33⅓ percent to 45 percent.

Says IBM Chairman Frank T. Cary: "The combination of IBM's expertise in data processing and COMSAT's experience in satellite communications should produce an effective technical team for advancing data communications."

Headquartered in Washington, D.C., with about 50 employees, CML has been developing plans for a domestic satellite system to relay specialized voice, image, and data communications. The new company's first satellite system is expected in the late 1970s. Eventually, IBM and COMSAT intend to offer shares in their joint venture to other investors or the public.

IBM's primary interest in the satellite business is to advance the state of the art in data communications and, thereby, benefit computer users, according to Cary.

IBM President John R. Opel emphasizes the "fundamental and growing interdependency between computers and communications." He explains that many medium- and large-scale computer users are looking for communications channels specifically designed for their needs, flexible enough to change with their organizations, and mobile enough to be used at remote locations. Data communications by satellite, he maintains, will one day offer those advantages, but more development work still has to be done.

IBM conducted its first satellite experiment in digital communications in 1962, using Telstar and, later, the Intelsat series of satellites. Last summer, the System Development Division laboratory in Poughkeepsie used a 36-foot antenna and experimental computer equipment to transmit and receive voice, image, and data communications via two Canadian satellites. With advanced techniques and specially designed IBM equipment, the six-month experiment achieved high quality and reliable communications. ■

But there were no doubters in Bermuda and that most certainly is not the bent in A/FE. For as staffer after staffer presented charts of facts and figures to describe the *challenge* confronting A/FE, the word was translated to mean "here's *what* we intend to do." And just as clearly, "here's *how* we will do it."

No one could mistake what Pfeiffer had in mind when he chose the theme, for there is no lack of challenge anywhere in the wide world of A/FE.

Geography makes the area difficult to manage; the distances are vast—9,000 miles north and south from the Arctic oil fields of Canada to the southernmost tip of Argentina, 16,000 miles east and west from the beaches of Rio de Janeiro to the government seat of India in New Delhi.

It is a world of languages that are difficult to master, cultures that are hard for the Westerner to know, political systems of every kind. And in economic development, the territory spans a world that ranges from a per capita income of $5,000 to one of $100 at the subsistence level.

On the matter of languages alone, take the case of Japan, the largest single revenue producer in A/FE. Even the simplified Kanji alphabet contains more than 2,500 characters, and no one, as yet, has perfected a keyboard that can handle it with speed.

But a pragmatist like Tak Shiina professes not to be dismayed.

"A couple of years ago," he laughs, "conversation in the U.S. just stopped anytime anyone mentioned Kanji. Now just about everyone knows what it is—so, at least, we seem to have made some progress."

But for all the complexities, the diversities, the problems—and global inflation is among them—Pfeiffer and the whole A/FE organization see only opportunity ahead.

Not without good reason. For as C. Fred Bergsten, a guest speaker and Senior Fellow at The Brookings Institution, observed, the world is undergoing an economic transformation. With the exception of Japan, which is

primarily a processing nation that adds high value to its raw materials imports, many of the lands of A/FE are rich in the mineral and natural resources now in high demand everywhere in the industrialized world. "Many of the *have not* nations," says Bergsten, "have become *have* nations in this turnabout." And A/FE very clearly sees its three-quarters of the world as a world whose time has come.

Not that the conference was all euphoric. There are a great many areas in which A/FE clearly has its work cut out.

Profitability, for example. This was the thrust of Pfeiffer's opening remarks. Bottom line performance. "This," he said, "is the challenge; we *can* do better than we have been doing." And he pursued it in every session right down to the closing line.

Profitability in A/FE, though hearteningly good by the measure of most other businesses, is nevertheless strained by that area's record rate of growth and inflation. The continuing need to invest heavily in personnel and support services in advance of additional income puts heavy pressure on the bottom line.

Unlike the Europe/Middle East/Africa Corporation, A/FE is not totally self-sufficient in IBM products. Much of its data processing and office products equipment must be ferried thousands of miles, some of it from Canada, some from the U.S., some from Europe. Annual freight charges, for example, run into many millions of dollars.

Inflation, now a global epidemic, exists everywhere in A/FE. Chile heads the list with a hard-to-believe runaway rate of 700 percent. In Taiwan, the annual rate is up to 63 percent. It's up to 38 percent in the Philippines, 30 in India, 28 in Colombia, and in the rapidly expanding marketplace of Japan, inflation is running at an annual rate of 22 percent.

Inflationary costs inevitably mean price increases, and IBM country companies have struggled to keep up. Because increases in many cases require months-in-advance government approval, the timing as well as the rate of increase can be critical, indeed.

But price increases, as Pfeiffer pointed out, are to be used only as a last resort in keeping up with inflation and never as a substitute for efficient and productive management in helping to hold costs down.

Critical as inflation is, however, the consensus seems to be that it need not impair the revenue growth and profitability of IBM A/FE.

Some, like Dick Tarrant, group director for DP marketing, see it as underscoring the need for computers and office products.

"Inflation," he says, "gives our customers additional incentive to go into computer systems. With wages and salaries going up everywhere, our products become more desirable because they do provide a clear way to increase productivity and, thus, fight inflation."

Cary had spoken in April of the increasing difficulties being posed by economic nationalism abroad and the phenomenon is apparent in A/FE although it varies widely from country to country.

Some, like Canada and Australia, for example, are especially sensitive to foreign investment, especially in the extractive industries. As yet, this sensitivity does not appear to have spread to the computer industry.

In Japan, however, economic nationalism remains a powerful force. Despite some recent liberalization in government restrictions, IBM must compete with subsidized national producers. During 1974-75 the government proposes to pay $80.2-million in subsidies for research and development to Japanese-owned computer companies.

In India, where that country's balance of payments situation has called down severe restrictions on imports, the IBM company there has found it necessary to pay its own way. This it does by producing unit record equipment for export to other A/FE companies and using those earnings to pay for the import of computers.

What this means is that the Indian company actually creates its own balance of payments to carry on the business. While revenues are modest compared to some larger country companies, IBM India's 1,150 employees are among the best educated; many hold three degrees. Other IBM companies have drawn on this talent, with 20 Indian systems engineers on loan throughout A/FE and Europe.

The opening session had started high up on the scale when Pfeiffer spoke confidently of the opportunity he foresaw in the years ahead for A/FE. For four days that optimism had not slackened. On the contrary, if anything, the mood was even brighter, not withstanding the many knotty problems that had been raised. What's more, the expectations had been calculated; they had become goals, and A/FE was very much in business.

Pfeiffer and Gordon Williamson, president of A/FE, closed the final plenary session at 7:42 p.m. There would be smaller group meetings starting at 8:30 the last morning and airplanes to catch that afternoon before the weekend Bermuda crowd.

With all the business, however, it had been a week of good feeling, occasionally punctuated with good-natured banter. As, for example, when a chart on the state of accounts receivable showed the Far East distinctly ahead of Latin America. Joe Beard, vice president for the Far East, suddenly straightened up and called out: "Now there's a beautiful chart—let's leave it up for a while." His Latin American colleagues shrugged and smiled. They had scored points on others.

That evening Ralph Pfeiffer hosted the group for dinner. But the talk was still mostly of business. They seemed anxious to get home and get started.

During the week, however, a subtle transformation appeared to have taken place. They were still whatever their country labels said they were, but they were now talking of themselves as A/FE. ■

Work style

Vacations are a must

Call it dedication if you will, but the executive who stays glued to his or her desk, deferring vacations at all costs, is hurting both his and the company's health.

Vacations used to be a regular respite from the pressures of business. Not anymore. In the last three years, more executive vacations have been cancelled, postponed, or interrupted than ever before.

The substitutes—adding extra days to weekends, holidays, or business trips—simply don't work. A number of doctors who specialize in caring for businessmen state emphatically that mini-vacations are unhealthy. According to one medical director, regular vacations of at least two weeks' duration are "absolutely necessary to break the pace." Executives who fail to take enough time out "run a serious risk of ruining their health." An additional tip: Get far enough away to resist the temptation of calling the office every day.

Nothing, *Fortune* noted, so enhances a person's "ability to think productively as a period of relaxation or a simple, but extended, change of pace. So vacations are not a luxury but rather a necessity for any businessman who wants to remain truly effective over a period of years and decades. Companies that value their executives, and executives who value themselves, will see that the vacations are taken."

(*Fortune*, June '74,
"The Boss Ought to Take More Time Off.")

Concentration on the job

Tough decision to make? Here are a few indecisive ways out.

- "We need more data." Safest dodge of all. Who can quarrel with a need for information? Result, no problem; action can be delayed, as long as you keep calling for information.
- "It's not my problem, it's theirs." Known as the fast shuffle, this technique is especially appealing when unpleasant decisions have to be made. Leave them to someone else.
- "What will Harry think?" Don't bother to ask Harry. Worrying about what your boss or someone else might think is always a comfortable way to stall a decision.
- "Good idea, but it will take someone higher up to swing it." A variation: "No one here has the authority." Either way, the name of the game is to duck it.
- "Both alternatives look good. We'll have to give it a lot more thought." Of course. Just keep batting the ball back and forth. With any luck at all, you may never have to reach a decision.

(*Iron Age*, January 14, 1974,
"Games managers play to avoid managing.")

Now you know it, tomorrow you won't

Half your business knowledge will be obsolete in 10 years. But, even if you decide to take a cram course by spending the next year in school, you still won't be ready for 1984. Because half of what you'll need to know then, isn't known now.

Mind-boggling? Yes, to say the least. And the key to handling this phenomemon, according to a recent study, is the ability to motivate people to continue learning. Motivating others starts with self-motivation. Here are some ways to begin:

- Set moderate goals to foster self-confidence; don't overreach to begin with.
- Have confidence in your own ability and you will instill confidence in others. Doubters produce doubt in others.
- Delegate authority. This demonstrates confidence in others and improves morale.
- Create channels for feedback. Learn to listen as well as talk.
- Think positively about the future and how to improve things. There is nothing that can't be improved.
- Take action to make things happen. Lassitude can be contagious.
- Develop a variety of interests and a sense of humor. It will help you keep your perspective.
- Learn to rely on intuition. "Don't be 100 percent logical. A man or woman who is all think and no feel is not able to motivate."

(Administrative
Management Society Report, published in
Administrative Management, May '74.)

Some observations on how to make yourself more effective and get more done

Turning them off

If you want to impress top managers with a presentation, don't use esoteric words. The advice, from Robert Anderson, president and chief executive officer of Rockwell International, was given recently to systems analysts, but it could apply to other professionals as well.

"Too often," says Anderson, "members of a profession believe they can impress others by using a mumbo-jumbo jargon which, in effect, makes them special keepers of some mysterious powers. I can assure you that this simply turns off a top manager, who will conclude that the information system is a thing apart and can never become a practical tool for day-to-day management."

(*Journal of Systems Management*, June '74, reporting Anderson's address to the Annual Conference of the Association for Systems Management.)

Worth remembering

Tunnel vision may be defined as the tendency of knowledgeable people at times to become so wrapped up in their own work or department that they build mental fences and become insensitive to the views of others.

(*Bits & Pieces*, The Economic Press, Inc.)

"The ability to listen is very rare. I have known very few men, particularly men in high places, who have been able to do it. Most public men I have known were not accustomed to the sound of any voice save their own . . . I must add that Mr. Truman not only had the ability to listen, he could *hear*, which is quite another thing. At the end of a conversation, he not only remembered what he had heard, but he understood and made use of it."

From an interview with Dean Acheson, former Secretary of State, by Merle Miller in *Plain Speaking, an oral biography of Harry S. Truman.*

How words fail

Using certain kinds of words is occasionally like waving a red cape in the face of a bull. Take "allness" words, for example. They include *all, always, everybody, every time,* and *never,* and they don't ring true because they convey an impression of totality—of knowledge that no one can have. Sometimes, the word "all" is implied in such references as "women," "minority people," or "today's college graduates."

Another short-circuit is "polar" language. These are word-pairs such as tall/short, near/far, objective/subjective, which convey a feeling of opposites. The terms are convenient, but rarely do they reflect reality. Problems seldom involve a choice between opposites. Such words usually express an extreme position that wasn't intended and invite prolonged—and fruitless—discussion.

A final note about snap reactions to provocative statements. Such reactions themselves provoke debate rather than discussion, with more concern about rebuttal than about new information. Pause a few seconds before replying to a provocative remark—to allow higher-level thinking processes to come into play.

(*Supervisory Management*, June '74, "Five Ways to Short-circuit Your Communication.")

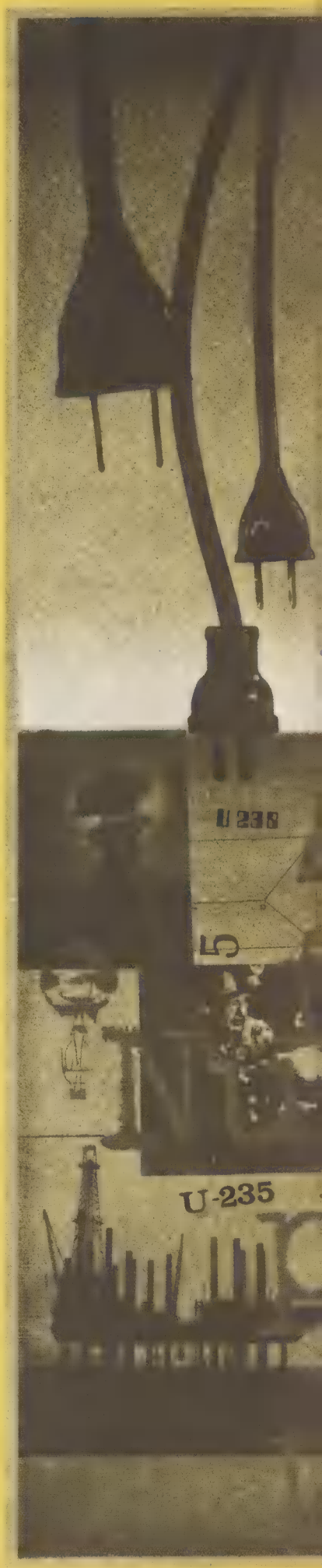
The person who throws up his hands, exclaiming, "I can't get any work done around here," may have some cause for frustration. Some perils to watch out for:

- Unpredictable sounds. They distract people, hamper thought and action, and impair performance for some time after they occur. Absolute silence is not a necessity either. In fact, some people prefer a steady background noise. Occasionally, to break the pace, set aside a "do not disturb" time.
- Clutter. Even people who perform well amid a scattered mass of unrelated paperwork may find that performance improves when their desks are clear.
- Distractions. Preview your "coming distractions" by thinking through tasks and planning them, talking with colleagues and checking files in the process. In the long run, it usually means less work and higher quality results.
- Stress. It fatigues and distracts. Sleep is often the best cure. An extra 30 or 60 minutes may make a big difference. Other aids: walking fast (improves blood circulation, sharpens the mind). And physical chores (relax the mind, perhaps allowing creative ideas to emerge from passive reflection).

(*Nation's Business*, June '74, "How to Keep Your Mind on Your Work.")

Pitfalls to decision-making

As energy goes, so goes technology



'I believe nuclear energy has arrived on the scene, historically speaking, in the nick of time.'

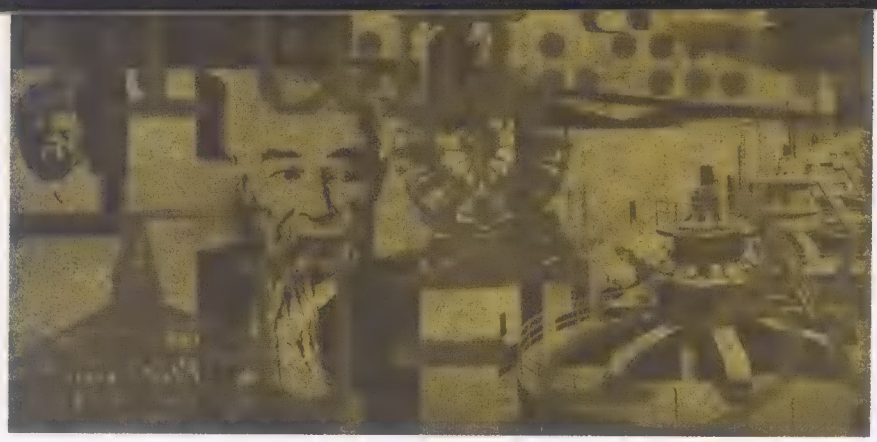
Glenn T. Seaborg
Nobel Laureate in Chemistry

Not many will recall who Thomas Robert Malthus was. He was a little-known British economist at the time of the American Revolution, best remembered today for the Malthusian theory to which he gave his name.

In that theory, first published in 1798, Malthus held that world population growth would inevitably outrun food supply and bring on global famine.

Technology has thus far stayed that judgment. In food supply, with the development of fertilizers, pesticides, irrigation, and mechanized farming. In production, with an ever-increasing cornucopia of manufactured goods.

But technology lives on energy and the outlook there



(Continued from page 28)

has become worrisome. Particularly in the case of oil and natural gas which together have accounted for nearly 80 percent of prime energy consumption in recent years. Reserves are now being consumed at a rate which, if continued, could eventually bring on energy starvation.

Clearly, the U.S. and other industrialized nations must find new sources of energy to replace oil and natural gas with other fuels. Fossil coal and fissile uranium are the two most likely substitutes. And of those two, uranium—the fuel used in nuclear, or fission reactors—looms as the energy source most likely to pick up the slack. Nuclear reactors, which today account for only about 4 percent of the world's electric power supply, are expected to produce half by the end of the century. Even oil-rich Iran is in the market for reactors.

Nevertheless, scientists are agreed that nuclear reactors—even breeder reactors which reproduce their fuel supply—offer only an interim answer. The ultimate answer to the exponential energy needs of an increasingly industrialized world would appear to be controlled fusion. This is the process by which inexhaustible energy resources could be generated from the hydrogen found in seawater. But because the technological task is a formidable one, the timetable on fusion is much too speculative for prediction. Yet optimists see it as a possibility, within the first quarter of the Twenty-first century.

Thus, for the next 50 years or more, fission energy would seem to hold the most promising—and some say the only practical—answer to mounting energy needs.

But nuclear reactors, like the fossil fuels they would replace, pose troublesome problems. What are the economics of nuclear energy production as opposed to coal which is still in abundant supply? How long will the supply of uranium last? How damaging are reactors to the environment? And how safe, or unsafe, are they?

These questions, and others, are explored in this Special Section of *Think.* They may give the reader a better grounding for further discussion of this important subject which is critical to our life-style, critical to the development of technology.

Richard Bode, an award winning freelance journalist, specializes in science and business. He spent several months interviewing experts in nuclear energy and visiting nuclear power plants before writing the following articles.

Without computers, there wouldn't be reactors

The role computers play

Nuclear energy and computer technology have coexisted for nearly three decades—each benefiting the other.

Indeed, there are experts who say that without computers nuclear energy might never have developed to the point it has.

And that, conversely, were it not for the computing demands of nuclear scientists, computers might never have moved along as fast as they have.

If credit must be given to a single agency for fostering this relationship, then it surely must be the Atomic Energy Commission (AEC), which has been in the vanguard of computer applications since its founding days. Indeed, nuclear scientists working under the aegis of the AEC have constantly pushed the computer to its uttermost limits—often out of painful necessity.

This was true in the Manhattan Project of World War II, when the United States was in a critical race to develop the atomic bomb. It is equally true today as scientists press to perfect power reactors to supplant the world's rapidly dwindling supply of fossil energy.

The AEC today is a vast, decentralized national enterprise with some two dozen independent facilities under its jurisdiction.

Some, like Brookhaven National Laboratory in eastern Long Island, N. Y., are dedicated to fundamental and applied nuclear research; others, like Argonne National Laboratory outside Chicago, are involved in physical and biomedical

research as well as reactor development, while the National Reactor Testing Station near Idaho Falls, which designed and operated early prototype reactors, is concerned with reactor demonstration and development.

Plants such as those at Oak Ridge, Tenn.; Paducah, Ky.; and Portsmouth, Ohio, are engaged in the production of enriched uranium fuel; others, like the Oak Ridge National Laboratory, are producing radioactive isotopes for medicine and industry.

And some facilities, like the Lawrence Livermore Laboratory in California, and the Los Alamos Scientific and Sandia Laboratories (both in New Mexico), are devoted primarily to weapons research.

These scattered facilities have two characteristics in common:

- First, none is operated by government personnel. All carry out their missions on a contract basis.

Their work, to be sure, is overseen and coordinated by AEC Headquarters in Germantown, Md. Under a typical contract, the AEC owns the plant and equipment, and it funds the operation. But a private organization operates the facility. Argonne National Laboratory, for example, is administered by the University of Chicago, and the Savannah River Plant is run by E. I. duPont de Nemours.

- Second, all facilities—including Germantown Headquarters — rely heavily upon computers. "I doubt there is an activity of man more intimately associated with computers than nuclear energy research and development," says M. H. Schwartz, director of the AEC's division of management information and telecommunications.

The statistics bear him out. The AEC has 1,311 computers of the Federal Government's more than 7,000 computers. Many are associated with the peaceful uses of the atom: reactor development, manufacturing control, and management information.

Dick King, the Data Processing Division's national account rep for the AEC, reports: "It's an exciting area because they are in the forefront of advanced technology.

"The Commission's need for data processing keeps expanding, so there is never really a dull moment."

Operating from Bethesda, Md., King, an IBMer for 22 years, not only handles the local AEC account in Washington, but provides staff services to the other branch offices that have AEC accounts. "We have a staff of two," he says, "Carl Papa and myself. But we cover a lot of ground."

The AEC long has cooperated in development of new computers and computing techniques. These cooperative efforts predate the Commission. They had their genesis in the Manhattan Project, from which the AEC was spawned. The story of that cooperation entails one of those fateful meetings that occasionally alter the course of history. The principals were the renowned mathematician, Dr. John von Neumann, who later served as a member of the AEC, and Herman H. Goldstine, who subsequently became an IBM Fellow at the Thomas J. Watson Research Center and is now on sabbatical with the Institute for Advanced Study (IAS) in Princeton, N. J.

In the early 1940s von Neumann was professor of mathematics and one of the permanent members at the Institute. In his typical energetic fashion, he was also serving as consultant to both the Army's Aberdeen Proving Ground (which was developing artillery firing and bombing tables) and to the AEC's Los Alamos Scientific Laboratory (which was trying to compute the characteristics of atom bombs). Goldstine, an Army lieutenant, was liaison officer at the Ballistic Research Laboratories at Aberdeen.

It was at his request that the original proposal for the ENIAC,* the first electronic computer, had been written.

The two men met by chance on a summer morning in 1944 on a wooden platform at the Aberdeen, Md., railroad station. Recognizing the mathematician, Goldstine walked up and introduced himself. A genial man, von Neumann asked the Army lieutenant what he was doing. And Goldstine replied that he was working on an electronic computer that could perform about 300 multiplications per second.

The mathematician, as Goldstine later put it, was "galvanized." He immediately saw the possibilities of applying computers to computational problems in weapons design. "We got on the train together," Goldstine recalls, "and from Aberdeen to Philadelphia he pumped me for details."

From that chance encounter, von Neumann entered into an active collaboration with Goldstine, himself a mathematician, plus J. Presper Eckert and John W. Mauchly, who were building the ENIAC at the Moore School of Engineering at the University of Pennsylvania.

Between 1946 and 1948, von Neumann and Goldstine published definitive papers on computer design and program planning. From the collaboration emerged the concept of the stored program. The landmark idea was ultimately translated into reality when a computer using internally stored instruction was completed under von Neumann's direction at the Institute for Advanced Study in 1952. By then, the AEC already had emerged as an independent Federal agency. Established by Act of Congress in 1946, it inherited control of the Manhattan Project, including all its technology and the zeal of its scientists for the role of the computer in harnessing the atom in the postwar period.

The AEC had supported, in part, the development of the IAS machine in the belief that it would be ideally suited to solve many theoretical problems that could arise in nuclear research. In its 7th Semi-Annu-

* Acronyms became popular for computers from the start. Those referenced in this article are:

ENIAC	Electric Numerical Integrator And Computer
MANIAC	Mathematical Analyzer, Numerical Integrator And Computer
ILLIAC	Illinois Automatic Computer
AVIDAC	Argonne Version of the Institute's Digital Automatic Computer
ORACLE	Oak Ridge Automatic Computer Logical Engine
JOHNNIAC	RAND Corp. named this affectionately for von Neumann

al Report, the AEC announced that construction of computers, based on the IAS prototype, was under way at Argonne and Los Alamos.

The names of the IAS-design progeny are now a part of computer lore: the MANIAC at Los Alamos, the ILLIAC at the University of Illinois, the AVIDAC at Argonne, the ORACLE at Oak Ridge, and the JOHNNIAC at the RAND Corporation. In the early 1950s, these machines were contributing immeasurably to computer technology, and many of the innovations found their way into general-purpose computers produced by industry.

"Perhaps our most important contribution," observes David H. Jacobsohn, facility planning coordinator and computer engineer at the Applied Math Division at Argonne, "was that we convinced industry that there was an important scientific market for computers.

"At the time, however," he adds, "we had no choice except to build these machines ourselves."

Much of the initial important computer developmental work occurred at Argonne, and Jacobsohn was deeply involved in it. A math major out of the University of Chicago, he joined Argonne in 1945, and the team assigned to build AVIDAC in 1949. "The project was supposed to terminate in two years," Jacobsohn recalls, "but the situation grew like Topsy. One project led logically to the next." Now, some 25 years later, the former Chicago student is still at Argonne, still working on leading-edge computer applications.

Shortly after the construction of AVIDAC, the AEC commissioned Argonne to build ORACLE, a similar computer, for its Oak Ridge facility. ORACLE was dedicated and shipped in 1953. Both ORACLE and AVIDAC were first-generation machines: their memories consisted of cathode ray tubes with a capacity of 1,024 words.

In the mid-1950s, the AEC authorized Argonne to build a magnetic core computer with a capacity of 4,096 words. In the midst of the construction of the new machine (dubbed GEORGE for "Let George do it!"), Dr. Donald A. Flanders, who was the director of what later became the Applied Mathematics Division at Argonne, sent down the following order: "Don't kill AVIDAC!"

Jacobsohn replied: "We didn't kill it. We just couldn't keep it alive. The tubes wore out."

After GEORGE, Argonne went on to build a number of computers for specialized purposes.

But it was with the completion of GEORGE that Argonne concluded its work in the general area of computer development and began to look to industry to satisfy its computing requirements. During its AVIDAC days, the laboratory also had an IBM 602 card calculator, and the two machines often worked together on reactor problems. GEORGE had hardly gone on-line when its work was taken over by a newly installed IBM 704. Today Argonne depends on two large IBM computers—a System/360 Model 75, which runs a time-sharing network, and a System/370 Model 195, which handles supersized scientific calculations.

These two machines have played an important role in the development of power-generating nuclear reactors as we know them today.

"Reactors probably wouldn't exist if it weren't for the computer," says Robert V. Laney, deputy director, operations, at Argonne. "It would have been nearly impossible to design a reactor by hand."

Laney observes that early, primitive reactors were, indeed, designed by "brute force." Physicists set up critical experiments to check out their designs. But as the state of the art advanced, the data proliferated, and it became impossible to test out alternatives through physical experiments. Instead, scientists built mathematical models (an idea von Neumann promoted years before) which allowed them to simulate experiments on the computer.

As Laney views it, computers become increasingly important as reactor design approaches the fringes of technology. This was true of fission reactors, and it is even more true of breeder reactors, where materials are being pushed to their limits of endurance. "In a comparatively low-technology field, such as building construction," says Laney, "you can easily over-design beams or girders and leave a large margin for safety. But in high-technology fields you can't do that. You have to know precisely how much stress a material can withstand. The data becomes so vast that it can't be manipulated manually."

Not all computer applications are confined to reactor research.

At the Savannah River Plant, an IBM System/360 Model 195 makes "charge calculations" for production (as opposed to power) reactors in the manufacture of plutonium.

The computer helps determine the configuration of fuel and other parameters so that the reactor produces predetermined amounts of fission by-products at the desired rate. The computer also maintains an inventory record of all materials so that their whereabouts can be tracked even after they are sold.

Computers also are involved in the AEC's regulatory program. Charles R. Troutman, Jr., chief of the information systems branch in the office of administration, says that 130 members of the AEC's regulatory staff are authorized users of a System/370 Model 165, and that 95 percent of regulatory computer usage is by access to that computer from a remote batch terminal.

Regulatory staff members use the computer for technical review of ongoing power plants.

Computers also seem destined to play an ever-growing role in controlled thermonuclear research. In a recent special report, Dr. John M. Dawson, of the Princeton Plasma Physics Laboratory [where studies of highly ionized gasses are conducted], called for the creation of computer centers dedicated to research. He wrote: ". . . recent advances in plasma simulation and computer technology provide the basis for confidence that the operating characteristics of large fusion experiments can also be predicted."

Through the years, the computer's involvement in all these activities has led to the proliferation of computer programs that pertain to all aspects of nuclear energy.

As far back as 1960, the AEC, at the request of the American Nuclear Society, created the Argonne Code Center, a central information agency and depository for computer programs.

Since its founding, the Center has operated under the direction of Mrs. Margaret K. Butler, a mathematician who also participated in the design and development of the earlier Argonne computers.

Today the AEC is clearly at a crossroads as ■ proportionately larger share of its resources are committed to civilian technology.

Appearing before the House Committee on Appropriations this past March, AEC Chairman Dixy Lee Ray requested $3.247-billion for the fiscal year 1975. This includes revenues, primarily from uranium enrichment, of $670-million. Thus, the AEC hopes to have $3.9-billion available next year. Of this total amount, the AEC plans to spend about $3.7-billion in 1975, compared with about $3.2-billion in 1974.

The biggest increases will go into energy development programs. Next year the AEC plans to spend 33 percent more for civilian reactor development, 55 percent more for controlled thermonuclear fusion, 54 percent more for laser fusion and advanced isotope separation, 25 percent more for regulation activity, 30 percent more for reactor safety research, and 73 percent more for nuclear waste management studies.

But the largest percentage increases of all—121 percent—will occur in applied energy technology, which embraces research and development of nonnuclear sources of energy. In her statement, Dr. Ray singles out geothermal energy, coal gasification, high-capacity underground electric power cables, and extraction of oil from shale.

As the result of these diverse missions, Congress is now reevaluating the AEC, and there is growing sentiment on The Hill to split the Commission into two separate units. The regulatory activities would be spun off into an independent agency. Meanwhile another agency would be established to promote energy research and development in all fields. A bill to accomplish that goal is in committee now, and many Washington observers believe its eventual passage is ■ foregone conclusion.

Thus, the destiny of the AEC appears uncertain. Whatever happens, one thing is clear: Nuclear and computer technologies will continue to help each other in the future as they have in the past.

Increasingly, reactors are becoming competitive with oil and coal

Economics of nuclear power

One morning last winter, Samuel Lovejoy—a 27-year-old communal farmer in the little Connecticut Valley town of Montague—loosened the guy wires on a 500-foot-high tower erected to gather weather data at a proposed nuclear power plant site, and sent the tower crashing to the ground.

Later that same morning, Lovejoy submitted a four-page typewritten statement to local police in which he assumed "full responsibility for sabotaging that outrageous symbol of a future nuclear power plant."

Elsewhere in the nation, others have voiced their opposition to proposed nuclear power plants with equal vehemence, albeit in more lawful ways. If anything, the controversy is bound to intensify as utility companies switch to nuclear energy in the wake of rising costs and dwindling supplies of oil and natural gas.

By July of this year, there were 48 nuclear power plants in operation in the United States. Thirteen of those had gone on-line during 1973 alone. Fifty-nine more plants are currently under construction, 111 others are on order, and utilities plan to build an additional 11, according to the Atomic Industrial Forum, an association comprised of business and other groups interested in the peaceful use of nuclear energy. Barring unforeseen circumstances, the industry expects some 400 to 500 nuclear units to be on-line by 1990 at ■ capital cost of $250-billion.

A large number of utility executives (especially those whose companies are far removed from supplies of coal) state they have no choice; nuclear energy is their only option for generating the vast amounts of electricity our high-technology society is expected to demand.

Authorities in government and industry are agreed on one point: Nuclear power plants will be producing more than 500,000 megawatts of electricity, or about 45 percent of the nation's electricity by the end of the next decade. That's quite a jump, especially when one considers that at the end of 1972 nuclear power was ■ mere "blip" in the statistics, accounting for 14,000 megawatts or less than 3 percent of present

capacity. The tremendous surge in electrical consumption—from 400,000 megawatts today to a possible 1.15 million megawatts in 1990—is predicted on two facts:

First, electricity is a versatile workhorse. It can light or heat a house, run industrial machinery, propel a train.

Second, there is growing recognition that each of the three prime fuels—oil, coal, and uranium—should be reserved for the job it can do best. And the only peaceful way we know how to convert uranium into power is to use it as the primary fuel in nuclear reactors that produce the steam that turns giant turbogenerators.

The chief advantage of nuclear energy is that a small amount of fuel can produce a vast amount of heat.

A number of startling comparisons dramatize the inherent energy advantage of fissile uranium over its fossil competitors, coal and oil: A cubic foot of uranium equals 7.2 million barrels of oil. A pound of nuclear fuel contains as much energy as 75 tons of high-quality coal.

The technology to convert uranium into power has been well established since 1957, when the first large-scale nuclear-electric plant began operating at Shippingport, Pa. To understand the sudden emergence of nuclear power, it is necessary to focus on two interrelated facts of economic life: costs and supplies.

At the begining of 1973, utilities in the Northeast were paying $4 for a barrel of oil. By March of 1974 it was up to $12. Some experts believe it may reach $18 by 1990. Others disagree.

Northeast Utilities in New England estimates that when oil is at $12 per barrel, its fuel costs are about 2 cents per kilowatt hour. But nuclear power has a current fuel cost of only two-tenths of one cent per kilowatt hour—one-tenth the cost.

The plain fact is that the world is rapidly running short of oil that can be recovered at a price many consumers can afford, if, indeed, it is not running out of oil altogether.

Government and industry sources give somewhat varying estimates about oil reserves, mainly because they base their calculations on different rates of consumption. One large corporation, Westinghouse, figures the U.S. has recoverable reserves for only 31 years, while the Federal Power Commission figures reserves at 44 years. The consulting firm of Arthur D. Little computes the "life index" of oil reserves (obtained by dividing present crude oil reserves by present production rates) at 10 years for the United States, 50 years for the Middle East, and 33 years for the world.

No matter whose figures one accepts, the conclusion is inescapable: The nation cannot for long continue on an oil-based economy. We must switch to other fuels, and the two most likely candidates for electrical power generation are coal and uranium.

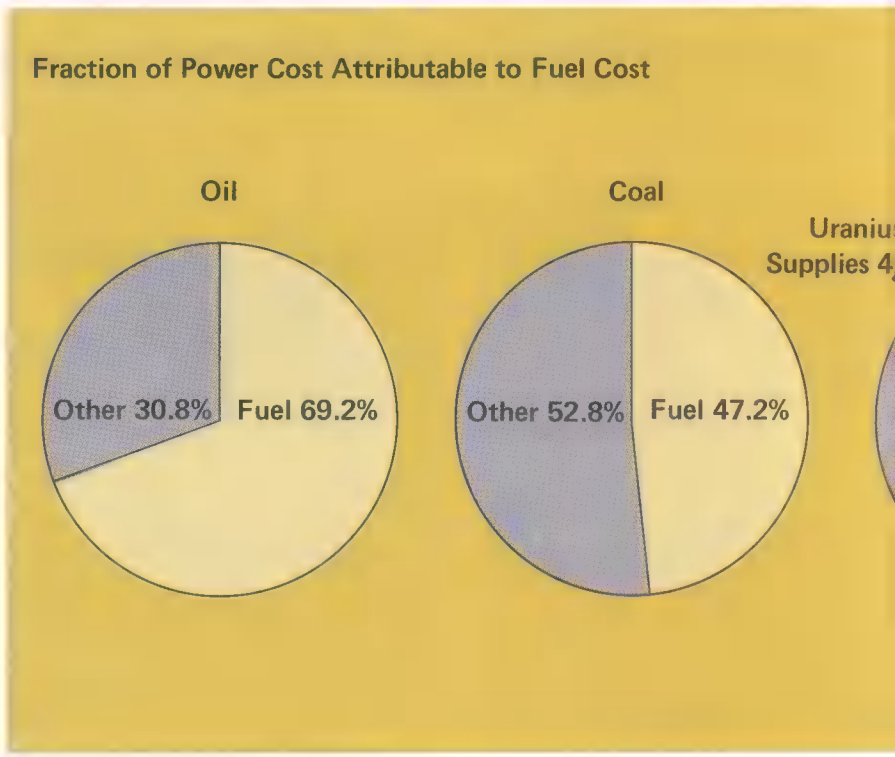
The U.S. has sufficient coal reserves for 500 years, so without doubt coal will resume a vital role in the country's total energy mix. But it appears unlikely that coal will once again predominate as a boiler fuel in the generation of electricity. Many authorities feel the future of coal lies in its conversion to a pure fuel for space heating, transportation, or petrochemical feedstocks through gassification, liquefaction, and hydrogenation.

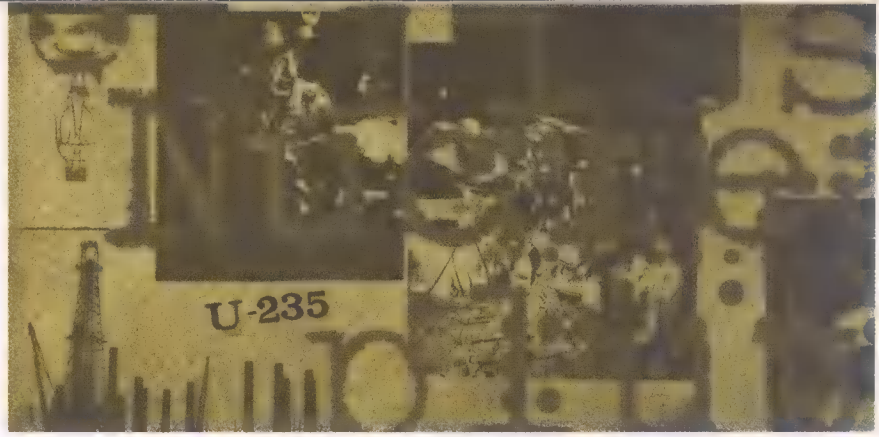
A study conducted by S. M. Stoller (an Arthur D. Little subsidiary) for Northeast Utilities projects the cost of electricity from a nuclear power plant, after an initial break-in period, to be three mills per kilowatt-hour lower than its closest competitor, a coal-fired plant *(see graph).* By the fifteenth year, the cost advantage grows to about seven mills.

It costs more to build a nuclear plant than one fired by either oil or coal. But the cost per kilowatt-hour of a nuclear plant is lower than either of the other two because of the low cost of the uranium fuel.

Uranium fuel (including mining, enrichment, and fabrication) represents less than 15 percent of total power costs, whereas coal represents 47.2 percent, and oil, 69.2 percent, according to the figures developed by Stoller this spring for another Eastern utility.

Comparisons like these help explain why so much attention is being focused on uranium now. But two critical problems must be resolved soon if this fissile fuel is to fulfill what appears to be its destined role. The first pertains to supply, the second to enrichment capacity.





How much uranium?

Reactors will require almost a million tons in the next 15 years

The earth's crust is believed to contain four parts per million of uranium. The metal is as plentiful as lead, more plentiful than silver or mercury. Even so, the U.S. has not yet identified sufficient reserves to carry it past the early 1980s. This does not mean the ore isn't there; but it does mean the economic incentives for its discovery have been lacking.

The nation's current uranium supply is largely an inheritance from the early 1950s when the substance was sought not for its value as a fuel, but for its use in weapons. Indeed, defense needs at the time triggered a metal hunt that can only be likened to the gold-rush days of a century earlier.

Today, the uranium mining industry consists of nearly 30 corporations with the financial resources to conduct scientific exploration and build the expensive mills which extract uranium from its ore in a form commonly called yellowcake, or uranium oxide (U_3O_8).

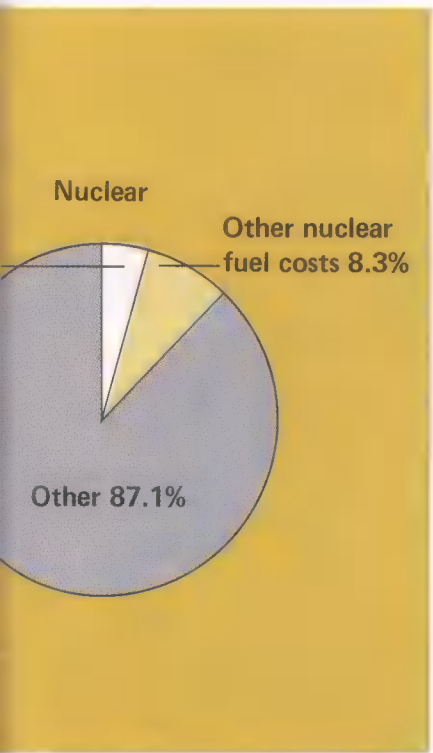
The reserves of yellowcake (like most resources) are generally described in terms of the cost of recovery. The Atomic Energy Commission estimates (as of January 1, 1974) that at $8 a pound, there are 277,000 short tons of uranium reserves. At $10 a pound, there are 340,000 short tons. At $15 a pound, there are 520,000 short tons.

These are all what the industry deems "reasonably assured" reserves. Above $15 per pound, however, there are another 1,000,000 short tons of "estimated additional resources." Thus, if the price is right, a supply in the neighborhood of 1,525,000 short tons is possible.

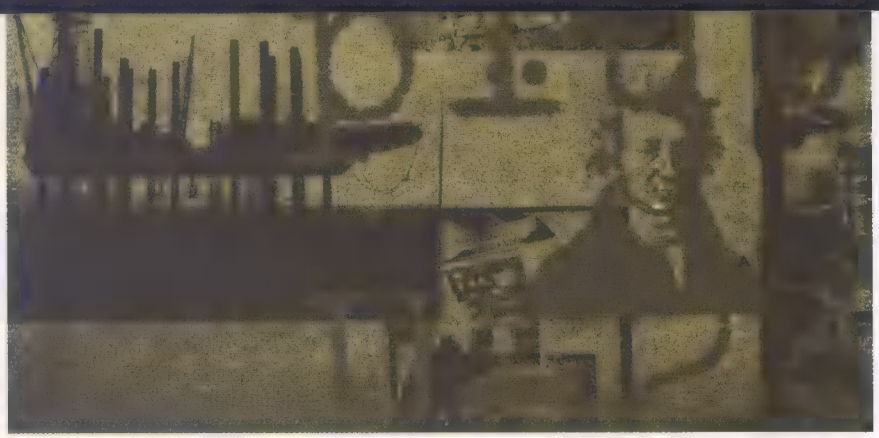
What about demand? The AEC estimated that between 1973 and 1990, utility companies and others will require a cumulative total of 968,500 short tons. The Atomic Industrial Forum figures that, to meet this demand, drilling will have to increase threefold between now and 1980, and that as many as 60 more mills (there are now only about 16) will have to be built by 1985. Experts note that it takes nine years from exploration to production of yellowcake.

To increase capacity to meet demand, the mining and milling industry will have to invest about $10-billion through the year 1990. There is general agreement that current uranium prices will not encourage an investment of this size. The market for yellowcake could only be described as "soft" in 1973: about $7.10 a pound. However, sources close to the uranium market report that prices for future delivery are starting to rise, a reflection of rapidly increasing demand. Almost assuredly the price of yellowcake will have to double, and possibly, treble, experts believe, to provide the necessary investment incentives.

Would a substantial rise in the price of yellowcake make nuclear power less competitive with coal or even oil? Not likely, authorities say. Since fuel costs represent such a small percentage of total power generation costs, the price of yellowcake can rise substantially without materially affecting the price to the consumer of the end product: electricity.



It's impossible to talk about uranium supplies without also



mentioning the potential of the "breeder reactor." The first commercial breeder reactors will probably not be on-line before the 1990s. When and if breeders do become available, they literally will extend uranium supplies for thousands of years. Unlike conventional reactors, breeders—as their name suggests—produce more fissionable fuel than they consume. Thus, many uranium experts expect the demand for yellowcake to taper off sometime after the turn of the century.

But many other experts feel that uranium sources should be uncovered in sufficient quantity to support nuclear power even if the breeder does not become available. The reason for their thinking isn't rooted in technology; few doubt that the breeder will be technologically feasible before too long. The reason is rooted in the fact that the breeder uses plutonium as its fuel and produces plutonium in large quantities. Plutonium is not only radioactive, but it is also highly toxic and hazardous to handle. Consequently, the breeder, in itself, is the subject of a growing controversy, the outcome of which is not yet known.

It will do little good to increase uranium supplies without also increasing enrichment capacity.

Uranium, as mined and milled, consists of two main isotopes (that is, their nuclei have different masses). The uranium isotope U-238 is not fissionable—or, at least, its core can't be split easily. But U-238 comprises 99.3 percent by weight of naturally occurring uranium. The isotope U-235 is fissionable, but it comprises only 0.7 percent by weight of uranium.

The small amount of U-235 in natural uranium would not sustain an economical chain reaction. Before the uranium can be used as a fuel in a reactor it must be enriched so that the fissile U-235 comprises about 3 percent of the total mass by weight. This is still a fairly small percentage of fissionable material, and it explains why authorities say a nuclear power plant can't explode. In weapons-grade uranium, the fissionable content exceeds 90 percent.

Years ago, the AEC constructed three enrichment plants: one at Oak Ridge, Tenn., another at Paducah, Ky., and another at Portsmouth, Ohio. These installations are operated for the AEC by private contractors; the first two by Union Carbide and the third by Goodyear. Two more enrichment plants will probably be required by 1983, and thereafter a new enrichment plant will be required every 18 months through the 1990s. And it takes 8 years to build one plant. The government wants to move enrichment from government control to the private sector; accordingly, the AEC has invited industry to submit plans for increasing future enrichment capacity.

An enrichment plant entails an investment of about $1.5-billion, exclusive of power supply. Quite naturally, no one company wants to undertake a venture of that magnitude all by itself. Today, only a few industrial consortia have declared their interest. But firm commitments must be made soon if new plants are to be completed in 8 years.

Fission offers a near-term solution but the ideal is fusion

Fission to fusion

It takes three years from the time uranium is removed from the ground until it is placed inside a reactor vessel.

First, the ore must be mined, then the uranium must be extracted from the ore at a mill. Next, uranium must be enriched and, finally, it must be fabricated into pencil-thin pellets about 1-inch long.

Experts say the fabricated fuel isn't hazardous; it can be handled and transported without danger.

At the power-plant site, the pellets are strung along 12-foot-long fuel rods, which are arranged in bundles. At Northeast Utilities Millstone Plant I, for example, the reactor core contains 580 fuel bundles, each with 49 fuel rods in a 7 by 7 array. Overhead cranes lower these bundles into precise positions inside the reactor's core, which resembles a honeycomb. It has been estimated that there is as much as $30-million worth of fuel inside a reactor at any one time.

The reactor is "fueled" so that the quantity and configuration of the fabricated uranium constitutes a "critical mass"—which means there is enough material present to sustain the fission process. The chain reaction builds spontaneously as the radioactive uranium gives off neutrons, which collide with fissionable U-235 atoms and split the core. Each collision results in the liberation of two or three additional neutrons and a large amount of heat.

It takes one-thousandth of a second from the instant a neutron breaks free of its nucleus until it splits another nucleus. Thirty trillion fissions per second produce one kilowatt of heat. The heat boils water to produce steam, and the steam turns the turbogenerator just as in any other steam-electric plant.

Naturally, the chain reaction must be controlled. Nuclear power plant operators can speed up, slow down, or stop the chain reaction by withdrawing or inserting control rods, which are part of the fuel bundles. The control rods usually contain boron, which has a great capacity to absorb neutrons. The boron rods—often called "poison" because of

their adverse affect on the chain reaction—reduce the neutron population in the reactor. Thus, by pushing in the control rods (which are regulated remotely from the plant's control room), plant operators can slow ■ reaction or make it sub-critical. By pulling out the rods, they can speed up ■ reaction.

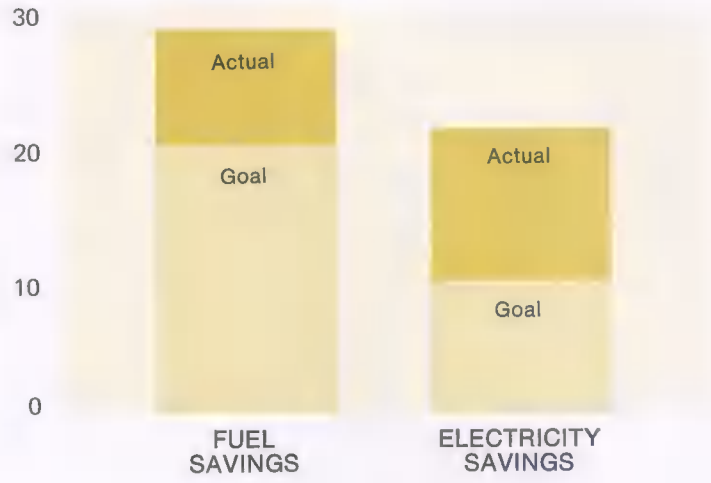
The on-going chain reaction—indeed, the entire operation of a nuclear plant —is monitored by ■ computer that receives input data from sensing devices. It's virtually impossible to open or close a door anywhere in the plant without triggering an audio "beep" and blinking lights on the enormous control panel.

Every second the computer at Millstone scans more than 2,500 digital inputs that indicate the status of valves, pumps, pressures—all equipment and functions. One of its most important chores is to monitor the "power level" of each of the fuel bundles in the reactor core. The information is vital to enable plant engineers to determine which control rods to insert, which to withdraw.

Nuclear reactors must be refueled periodically. During refueling, the plant must be shut down for several weeks. About one-third of the fuel is replaced each year. Spent fuel is usually removed from the center of the reactor core. The remaining fuel in the reactor (which is usually not depleted) is shifted to the center, and new fuel added to the outer part of the core. Then the reactor is sealed and allowed to go "critical" once more.

Some observers say the spent fuel in the reactor is highly hazardous; it must be moved and stored underwater in ■ shielded area of the plant to allow its radioactivity level to decrease. Then it is shipped in special transfer casks to ■ nuclear fuel reprocessing plant. The small portion that can't be reprocessed must subsequently be sealed and buried at a permanent waste repository designated by the Atomic Energy Commission.

The ability to reprocess large portions of the spent fuel is a characteristic that separates the nuclear plant from the fossil-fuel plant. In the fossil-fuel plant, once the fuel is burned it is consumed.



Inside IBM

An energy update

What ever happened to the energy crisis? Plenty at IBM, where the Real Estate and Construction Division reports that major locations have saved 28 percent in fuel and 21.2 percent in electricity through the end of May, topping goals of 20 and 10 percent set for the two areas last November.

A major thrust in the conservation effort is the continuing installation of System/7s by the locations to implement programming being developed at Boca Raton for some 20 sites throughout the United States through 1976.

The first phase of the program, already in operation at Boca Raton and Armonk, involves the on-off control by computer of heating, ventilating, and air conditioning equipment. The system also monitors electrical demand in a process called "peak shaving." Power companies base their charges for electricity on the highest consumption period for each month. In other words, on the peak consumption rate for ■ period such as 30 minutes even though usage for the rest of the month may be lower. By anticipating peaks and turning off selected electrical equipment before they are reached, the System/7 can effect considerable savings.

The second phase of the program is the development by Boca Raton of ■ more comprehensive method of controlling heating and cooling within ■ building by ■ continuous balancing of systems—rather than on-off control. When the sun strikes the side of a building, for example, cooler air is fed to that area automatically, while the rest of the building is not affected. This method of optimizing energy use is already being employed in the One IBM Plaza building in Chicago.

East Fishkill, Rochester, and Endicott are currently employing System/7s for energy management of powerhouse equipment such as refrigeration machines and boilers.

"It is as though Providence had laid out a path for man to follow. For each step in man's exploration of the resources of our planet appears calculated to carry him just far enough to reach the following step. Fossil fuels have lasted long enough for us to discover uranium, and the process of nuclear fission. Uranium reserves are sufficient to carry us to the age of the breeder reactor. . . . The breeder will greatly extend our nuclear fuel supply—buying time enough, if all goes well, for scientists to reach what appears to be the ultimate phase of power development: nuclear fusion."

William R. Gould
Senior Vice President
of Southern California Edison Company

PRESENT AND PROJECTED NUCLEAR POWER CAPACITY

	January 1974		December 1980		December 1985	
	billions of watts	*number of plants*	*billions of watts*	*number of plants*	*billions of watts*	*number of plants*
United States[1]	32.4 (26.4)	54 (44)	130 (102)	155	300 (250)	310
Soviet Union	2.6	9	15	25		
Japan	3.1	7	32	40	60	65
Canada	2.5	6	7.5	13		
Sweden[2]	.4	1	8	11	16	19
United Kingdom	5.6	14[3]	11.8	19[4]	30	38
France	2.8	11	13.5	23	50[5]	47
Germany	2.3	11	20	30	40	46
Italy	.6	3	6	9	18	21
Community Total	12.2	42	56.8	90	153	172
Western Europe (less EC and Sweden)	2.0	6	22	31	42	51
Eastern Europe	.6	3	8	19		
Asia (less Japan)	.9	5	5	12		
Latin America	.3	1	2.7	5		
World Total	57.0	134.0	287.0	401.0		

Source: Commission of the European Community

[1]The dubious accuracy of this table (which is nevertheless the most comprehensive available) is suggested by the figures in parentheses, which show present capacity and number of licensed plants, according to official U.S. sources. The best estimates for nuclear-power capacity in 1980 and 1985 have recently been revised downward as indicated. Figures for other countries are also open to question, but the discrepancies are smaller.

[2]Figures for Sweden—not given in the EC document—have been inserted.

[3]Consisting of 28 reactors.

[4]Consisting of 39 reactors.

[5]French capacity in 1985 has been corrected to reflect a recent decision to add a further output of 13 billion watts.

But the nuclear plant—whether conventional or breeder—produces new fuel all the time.

During power production, the fissile U-235 is largely consumed, releasing energy and neutrons. Some of those released neutrons are captured by the nonfissionable U-238 nucleus. The capture of neutrons transmutes nonfissionable U-238 into fissionable plutonium, a man-made by-product of the nuclear chain reaction. As a result of the "alchemy," a portion of natural uranium is converted into plutonium, which can now be reprocessed and used in the enrichment of new fuel.

The successive steps from mining to reprocessing comprise the "fuel cycle." A complete cycle takes about five years.

* * *

The fission reactor produces about 6 atoms of fissile plutonium for every 10 atoms of uranium it consumes. The fast breeder reactor will produce 14 atoms of plutonium for every 10 atoms of fuel it consumes.

The Atomic Industrial Forum estimates that over a 50-year span, the breeder could reduce by 1.2 million tons the amount of uranium that would otherwise be consumed if the nation depended on fission reactors alone. In addition, the Forum says breeders have a potential fuel cycle cost of 0.4 to 0.7 mills per kilowatt-hour, compared with 1.1 mills for today's conventional reactors.

Is the breeder reactor the ultimate answer to power production and the conservation of fuels? Obviously not, for even the breeder has fuel and efficiency limitations. Most experts believe the breeder will enable the nation—and, indeed the world—to "buy time" for the development of nuclear fusion.

Fusion is just the opposite of fission. In fission, energy is released when heavy atoms like uranium are split. In fusion, energy is released when light atoms like hydrogen are fused. The difference is

that uranium is relatively scarce and expensive whereas hydrogen is abundant, accessible, and cheap.

The Nobel Chemist Glenn T. Seaborg, former AEC chairman, has observed that ". . . controlled fusion would give us an energy equivalent of 500 Pacific Oceans filled with high-grade fuel oil."

Nuclear fusion is the same process that occurs on the sun, which obtains its energy by fusing ions of light hydrogen to form the heavier atoms of helium. On earth, hydrogen fuel (actually hydrogen isotopes deuterium and tritium) would come from the renewable resource, seawater.

So far, however, a controlled fusion reaction has remained only a theoretical possibility. To achieve controlled fusion, a small quantity of the fusion fuel must be heated to a temperature that exceeds 100,000,000 degrees Centigrade (180,000,000 degrees Fahrenheit). Then this superheated fuel must be contained in a virtual vacuum long enough for the hydrogen ions to fuse. A tiny amount of fuel releases an enormous amount of heat—far more than the amount needed to trigger the fusion.

The technological problem centers on containing a reaction at such astronomical temperatures. The hot fuel must be isolated from the walls of the reactor vessel, for no material can withstand such extraordinary heat.

Since the earliest days of fusion research, scientists have been trying to contain the plasma within intense magnetic fields, often called "magnetic bottles." More recently, researchers have been trying to induce a contained thermonuclear fusion reaction by striking tiny pellets of fuel with high-powered lasers.

Scientists in the U.S., the Soviet Union, the United Kingdom, Western Europe, and Japan are encouraged by their progress. A high degree of international cooperation exists in the field. Even so, most observers doubt we will have fusion power until well after the year 2000.

But the scientific community appears almost unanimously agreed that it is worth striving for.

Fusion plants will not produce large amounts of radioactive wastes, and they will be more efficient than fission plants. Scientists believe they may even be able to transform fusion power directly into electricity without first converting it to heat. Best of all, fusion holds the promise of providing man with something he has never had: an inexhaustible supply of fuel. ■

Counterpoint

Some say let's not put all our money on nuclear power

From the depths of last winter's fuel crisis, many experts looked with hope to nuclear power as a potential source of reliable, inexpensive, and clean energy that would satisfy environmentalists as well. Such optimism has been tempered by recent statistics suggesting that the U.S. might be wise not to put all its energy eggs into a single nonfossil fuel basket.

The basic problems, according to a report in the June 10 issue of *U.S. News & World Report,* are that many of the nuclear power plants already constructed have been beset by design flaws, faulty workmanship, and inadequate quality control, causing endless breakdowns at enormous cost in time and money.

The Atomic Energy Commission reported that every reactor in the U.S. had at least one "abnormal occurrence" in 1973. During last January's energy crunch, 22 nuclear plants were inoperative part, if not all, of the month, including 16 shut down for maintenance or repairs.

Safety was another spectre raised during plant breakdowns. Small amounts of radioactivity escaped the precautionary "containment" area. Of the 861 "abnormal occurrences" in 1973, 43 percent had "potential safety significance." Eighteen incidents involved "significant hazards." In 12 of those incidents, radioactivity above the acceptable level was released beyond the plant-site boundaries (although still within safety limits defined by the AEC). One Michigan plant has operated full-tilt only five months in two and a half years—because of three series of leaks of radioactive steam. The shutdown has cost $3-million per month, a cost eventually passed along to consumers.

"Many of these occurrences would have been prevented," says L. Manning Muntzing, AEC director of regulation, "had strong quality-assurance programs been in effect." The AEC is trying to help the nuclear industry improve quality control at the 45 U.S. atomic plants now operating commercially.

Another problem is the escalating construction costs of nuclear plants. The ten plants licensed to operate by 1971 took, on the average, less than six years to go from the planning stage into service. Today, it takes an estimated nine to ten years. Delays stem from lengthy licensing procedures, construction and technical problems, and intervention by safety and environmental groups.

Specialists who recognize the need for alternate energy sources to fossil fuel suggest that, based on results so far, the U.S. should not put all its research, talent, and money into one alternative. They view nuclear energy as just one of a number of options available.

SAFE

One of the most formidable barriers to nuclear power expansion has been the public rejection of the reactor sites themselves. Some citizens oppose reactors on ecological grounds. Others on grounds of safety. More recently, the pressing need for more power has softened some of this opposition. But, despite the energy crisis, the dispute continues. Here, *Think* presents the opposing views of two authorities.

by W. Kenneth Davis, vice president
Bechtel Power Corporation

Is nuclear power a hazard to the public, or, even as alleged by some, to the future of mankind? Let's look at the safety records:

After 17 years of commercial nuclear power use in America, and more than 20 years of military nuclear power use, there has not been a single injury or monetary loss to a member of the public. This record of public safety is unexcelled by *any* other industry. That hasn't been good luck. There has been very great emphasis on safety and reliability in the development and evolution of nuclear power plants—and in the design, manufacture, construction, and operation of these plants.

Before construction of a nuclear plant can be started, formal approval is required from the Atomic Energy Commission. As a part of its application for a construction plant, a utility must produce a detailed quality assurance program and an analysis of all possible hazards.

The applicant's statements and conclusions are scrutinized separately by the AEC regulatory staff and by an independent group of consultant experts called the Advisory Committee on Reactor Safeguards. A third body called the Atomic Safety and Licensing Board conducts public hearings on environmental and safety issues related to each licensing action.

What has evolved is the so-called "defense-in-depth" concept of design. Multiple-redundant safe shutdown mechanisms are specified for every nuclear power facility. These are independent systems, each with its own separate backup in case of failure. They are backed up even further by "passive" safeguards, such as special leak-tight containment structures. The guiding concept is that no single component breakdown can lead directly to failure.

Other issues have been raised regarding the wisdom of continued nuclear development.

First, the nagging issue of radiation risks from nuclear power plant operations. Whether we like it or not, we are all enveloped in radiation from many natural sources. All radiation, whether man-made or from nature, can be measured in a common unit called a millirem, and background radiation roughly averages 130 millirem per person per year. We must assume this can be accommodated by man, since the human race developed in its presence.

By contrast, routine effluents from a fully developed nuclear industry by the year 2000 are expected to contribute, on the average, roughly 0.2 millirem per year, or about 1/1000 of the total exposure from natural and medical sources.

But what about plutonium, the uranium by-product from reactor operations? Some call it the most toxic man-made element known.

Plutonium is, indeed, a very hazardous material and must be handled accordingly, but this applies also to mercury, cyanide,

UNSAFE

by Henry W. Kendall, professor of physics
Massachusetts Institute of Technology
and
Daniel F. Ford

The safety problems of nuclear power plants have not, in our opinion, been fully acknowledged by proponents of nuclear power. They have for the most part been disclosed by independent technical studies that a number of groups of scientists have conducted over the last few years and by "leaks" to the public of several thousands of pages of government internal files.

The accumulated evidence suggests that the possibility of ■ catastrophic accident at ■ nuclear power plant (NPP) is very real. A single NPP of typical size contains in excess of a thousand times the amount of radioactive material produced in a Hiroshima-size nuclear weapons detonation. Approximately 20 percent of the material is gaseous in form, and if accidentally released, could be easily borne about by the wind. While there is no possibility of a nuclear explosion precipitating such a release, other sequences of events, such as overheating of the reactor core following loss of normal cooling water through accident, natural disaster, or sabotage, could set the stage for such a major release.

One government study, in 1965, concluded that tens of thousands of people could receive lethal doses of radiation in such an event, people who live at distances extending up to several dozens of miles from the reactor. According to one estimate, the possible area of disaster might be "the size of the state of Pennsylvania."

The operating records of the U.S. nuclear program show a significant number of breakdowns in critical nuclear power plant safety systems, along with previously unsuspected safety problems.

Faulty quality assurance in the nuclear industry, as in any industry, is possible, and, we believe, has frequently occurred. For example, control rods, an NPP "emergency brake" system, have been found to have been assembled with their critical components upside down—and they aren't designed to work that way. Defective valves have been installed in NPPs, as part of basic safety systems. No member of the public has been killed to date as a result of these errors, a fact which one AEC study said was "largely the result of good luck."

It also is our belief that insufficient testing has been done to confirm the effectiveness of reactor safety systems, such as the emergency cooling system. This system—designed to prevent overheating of the reactor's uranium core— has been designed largely on the basis of simulation and mathematical modeling. We believe that the models are overly simple ones which do not adequately represent the physical phenomena which would be involved in an actual reactor accident, and that these mathematical models incorporate several inadequately reported assumptions.

A public controversy over the adequacy of governmental

arsenic, asbestos, and many other materials used widely in our everyday life. The important point to remember is that the hazard is not simply a property of the material itself, but also is dependent on such factors as its mobility in the biosphere, its pathways to man, its change in potency with time, its retentivity in the human body, and last but not least, our ability to detect and monitor its presence in concentrations which are well below the danger point.

Present instruments can provide early warning by detecting several orders of magnitude below the amount of plutonium which would be considered hazardous. There has been extensive experience in handling plutonium in many forms and over many years, and demonstrated technology is available. For the many other poisonous materials, our measurement ability is often not far below the threshold of noticeable injury.

The second injury risk is that of a major accident.

It is a confirmed fact that the light-water reactors used for commercial nuclear power *cannot* be made to blow up like an atomic bomb. Imaginative people have done their best to think up improbable and hypothetical accident sequences which might produce a nuclear explosion, but they cannot get around the fact that the fuel used in power plants contains materials which are so diluted—and so arranged in the reactor—that any significant disturbance would cause the reactor to shut down rather than explode.

Recently a theoretical study was conducted at M.I.T. Using actual plant designs, known reliability data on components, and known weather conditions, the likelihood of major reactor accidents was calculated. The probability of a catastrophic accident (one with ten times the fatalities of a large airliner crash) was stated as being equal to, or less than, one chance in a billion years for each reactor unit. The possibility of a less severe accident (with consequences similar to those resulting from one large airliner crash) was assessed as being one in a million years.

For those who feel threatened by probabilities of one in a million or billion years, these statistics are unimpressive. However, they can be viewed in perspective only when other man-made threats and probabilities are compared with them. With a chance of one in a billion per year for a catastrophic reactor accident involving the public, we can project that for the approximately 1,000 reactors which are expected to be operating in the year 2000, the chance of such an accident would be one in one million per year.

In contrast, for large dams the chance of a major failure is one in 10,000. With 600 dams in the U.S., the chance that there will be one failure per year is 1 in 10.

Review of the literature from the National Safety Council indicated that nuclear power entails perhaps the lowest public health risk of all industries.

Proper control and ultimate disposal of nuclear waste is another thorny problem. The fission fragments have a lifetime on the order of 1,000 years, and heavy elements have lifetimes in the hundreds of thousands of years.

What do we know about the handling of such materials?

First, we know how to separate, concentrate, and solidify them. This is now being done in modern fuel reprocessing plants. There is considerable effort under way to determine the best low-cost approach for the ultimate disposal of solidified waste. One approach with considerable promise is that of

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computer-based safety analysis erupted in 1972, during Atomic Energy Commission hearings on safety policy. The AEC made some changes that they hoped would upgrade the analysis. We support the view, however, of one expert who recently stated: "The safety analysis is still as shaky as it was two years ago. Additional work is being done and some of it is of fairly good quality. However, the reactors still have not been shown to be safe."

Then there is a possibility of misuse of nuclear materials. A recent book by Theodore B. Taylor and Mason Willrich, *Nuclear Theft: Risks and Safeguards,* establishes the ease with which a nuclear explosive device may be fabricated from fissile materials illicitly obtained from the nuclear program. The study reported in the book was initiated and supported by the Ford Foundation Energy Policy Project. Taylor, an expert weapons designer, and Willrich, a lawyer with experience in the safeguards area, concluded that the threat posed is very real and that present safeguards to the security of fissile materials are inadequate. This inadequacy stems, in their view, from a lack of sufficient commitment to develop a fully effective program of safeguards. These conclusions are similar to those developed in a number of other, somewhat less comprehensive, studies carried out in the past few years.

There are continuing problems related to the ultimate disposal of radioactive waste generated in the nuclear program. The radioactive material, primarily the "ashes" from the burning of uranium, present an additional problem after they are removed from a reactor. The ashes are separated chemically from the fuel and must be sequestered for immense periods of time. They cannot be allowed to return to the environment while they still present a hazard to life. About 95 percent of the wastes must be stored for periods of from one to two thousand years before radioactive decay has diminished their toxic potential to tolerable levels. The remaining 5 percent, comprising some of the most toxic materials known to mankind, persist far longer and require periods in excess of 100,000 years before becoming harmless.

There are now no satisfactory techniques for separating the two components, and the quantities of waste products presently accumulating must thus be removed from the environment for geological periods of time. Unfortunately, there are presently no wholly satisfactory schemes for disposing of these materials in such a manner that they will surely remain sequestered for the periods involved. In the U.S., in a documented failure of a waste storage program, hundreds of thousands of gallons of high-level toxic radioactive reactor wastes have leaked from storage facilities.

* * *

The aggregate difficulties in the U.S. nuclear program have understandably generated acute concern among groups outside the nuclear program who have studied them. The RAND Corporation, in a study carried out for the State Assembly of California, recommended a slowdown in that state's nuclear plant construction until the reactor safety issue was resolved. The Federation of American Scientists concluded that AEC

burying the solid waste in deep geologic formations which have been physically and chemically stable for millions of years.

What seems to be frequently ignored about nuclear wastes is their relative physical amounts compared to those of other methods of power generation. For example, four empty cement sacks would hold the waste produced from supplying nuclear energy to a city of 100,000 population with all its electrical energy needs for one year. The small amounts of solidified wastes could be stored safely in retrievable form in government repositories until long-term solutions are found.

The transportation of fuel constitutes a major interface between the nuclear power industry and the general public—but a negligible risk. To date there have been no injuries or deaths of a radiological nature due to the transportation of nuclear materials.

Finally, the government has long recognized that the public security aspects of "weapons" material control warrant special, complex, and thorough attention. Since nuclear material used in the present commercial power plants cannot be used to make a bomb, the present control system would seem to have been adequate.

However, within ten years or so, significant quantities of fuel materials will exist in the commercial power sector which might be considered to be "bomb material" if properly separated and purified. The point is well made that in the future closer security and better accountability will be essential. But the more stringent security measures need only be directed at a small segment of the nuclear fuel cycle—after reprocessing of spent fuel and before its refabrication. ■

studies did not support the claimed reliability of reactor emergency systems. The British Government's review of the alleged safety of U.S. reactors, carried out in connection with that country's wish to purchase nearly two dozen U.S. plants to alleviate their electricity supply problems, was deeply disquieting. Scientists, including the Chief Scientific Advisor to the Government, strongly advised against the purchase on safety grounds. The preliminary report of the Ford Foundation Energy Policy Project shows evidence of considerable concern. One of the project's advisors noted that the report "suggests that nuclear power is an emerging science—risky and only partially understood." The 1973 Pugwash Conference on Science and World Affairs found that: "Owing to potentially grave and as yet unresolved problems related to waste management, diversion of fissionable material, and major radioactivity releases arising from accidents, natural disasters, sabotage, or acts of war, the wisdom of a commitment to nuclear fission as a principle energy source for mankind must be seriously questioned at the present time."

We believe the nuclear program is in serious trouble. Nuclear power is, at best, a potentially ultrahazardous technology. When this potential is coupled with impressive documentation of unexpected and severe engineering difficulties, it is clear it would be wise for the nation to pause and review its commitment to the program.

Unless the array of problems, both managerial and technical, can be resolved, an expanding program and, ultimately, a national reliance on nuclear energy cannot be justified. ■

Washington perspective

'I think large segments of the general public now recognize — and public opinion surveys have confirmed this — that nuclear power must play a larger role to make up for shortages of oil and natural gas. Nevertheless, there is a vocal minority which is still strongly opposed to further expansion of power from the atom. In fact, the recent energy crisis did little to enhance the position of nuclear power in the minds of our foremost critics . . .

'To me this [nuclear power] seems like a reasonably risk-free solution to our energy problem. If the public understands these risks and balances them against the many other risks we take in the course of our normal activity, I think the opportunity for nuclear power to make a valuable contribution to this nation's energy supply would be enhanced.'

—Dr. Dixy Lee Ray
Chairman of the Atomic Energy Commission
Washington, D.C., May 16, 1974.

A visit with the OPD manager at

Twin Cities West

Bill Young scans the line of passengers getting off the plane. For a late Wednesday afternoon, it's fairly crowded at the Minneapolis airport. Young has just driven from the Twin Cities West branch office in Minneapolis where since January he has been branch manager for the Office Products Division. He is looking for Denny Koskovick, the new branch manager in Cedar Rapids, who will be taking customers to see some top Minneapolis word processing accounts tomorrow morning.

Young breaks into a smile. Koskovick gets a big handshake. It's a reunion. They were marketing managers together in Minneapolis. Now, they're comparing notes on their new roles as branch managers, rattling off sales figures by product area.

Young drives his guest home, where the two OPD managers spend most of their time talking about people—old friends, managers, and the people in their offices, but only until midnight because the two men have a date the next morning before the start of the business day—playing handball at 7.

* * *

At 31, William K. Young is one of the youngest branch managers in IBM. His youth is characteristic of OPD, one of the fastest growing parts of the company. While no branch manager is typical, nor is any branch—each takes on a unique quality and atmosphere of its own—a visit with Young does provide some insights into OPD's style.

Young's management philosophy is simply put: "Keep your people happy and cover your quota. In that order. Happy people sell. There's no statistical formula to make quota. People don't sell to companies. They sell products to people through people."

That philosophy comes through in Young's day-to-day operation. His door is always open. His secretary, Ruth Page, says: "He'll never send anybody out by saying 'I'm busy' even if he's up to his ears."

Young's world is an OPD microcosm of about 20 people, at 5075 Wayzata Boulevard, ten minutes from downtown Minneapolis. Business comes from western and northern Minneapolis suburbs. The 150-square-mile territory varies from a single real estate agent or lawyer to schools and a state reformatory in St. Cloud to the north, and the world's largest harvester of wild rice in Mille Lacs County.

Since Marketing Manager Leighton Jackson is at management school in Dallas, Young dashes off to help Mar-

keting Rep Jim Liljeberg with a Copier demonstration.

The customer, a purchasing manager for a small electronics company, arrives. In short order, Young is asking her what she would like in a Copier. He listens closely.

Liljeberg gives the demonstration. Young steps to a flipchart and points out the features of the Copier II.

A little later, Young asks: "What do you think of the Copier II? What features do you like? Do you like the reliability?"

She's impressed.

The next morning, Young will visit Liljeberg to ask him what he liked and disliked about the demonstration. "Out of the discussion," says Young, "we'll learn how to improve the next one."

Young explains that there are three kinds of selling. "The method approach says, 'Here's my typewriter, let me show you how it works.' In application selling, it's, 'Here's what I understand as your work that needs to be done. Let me show you how IBM products will do this for you.' Finally, there's the consultative or systems approach, 'I, believe I understand your office and what you're trying to do. If we change certain tasks as follows, I think we can achieve those results in an optimum way.'

"I believe in the consultative approach," adds Young. "It's highly beneficial to both the customer and IBM. When we use this approach, we start off with lots of questions, lots of listening, and very little telling."

Carol West, a sales trainee about to go on quota, visits Young's office.

Young gets into a detailed description of the territory, pinpointing potential customers. "We need to sell more typewriters in this territory," says Young. "Either for economic reasons or because we're not selling replacements, we're not hitting a high percentage of Correcting Selectrics. I suggest you start by getting the customer list and marking all the possible replacements.

"Get the method and application selling down fast," says Young. "Then we'll move into systems marketing. You've done an outstanding job as a trainee. I can't think of a better person to put in the territory."

* * *

Young relishes the people aspect of his job. "In the Midwest," he says, "we learn to talk with people. Maybe that's because it was the only thing we had to do. There seems to be more patience and more time for people. Now that's important to us in OPD whether we're dealing with customers or IBMers."

Bill Young traces his natural Midwestern style back to Galesburg, Ill., where his father was produce manager for the local A&P. His father and mother and their three children moved to Williamsfield to start their own general store, "with everything from Levi's to T-bones.

"I was involved in selling," says Young, "ever since I could reach a bag of potatoes and a cash register."

With a B.A. in math from Knox College in Galesburg and pursuing a master's in teaching arts from the University of California in Los Angeles, Young was recruited for a teaching post.

One vacation weekend in Chicago, he wandered into an IBM recruiting office. "I'm a teacher," he said, "and I'd like to sell something." Young was sent on an interview at the Milwaukee branch office, where he joined IBM in August 1966 and spent the next two and a half years as an OPD salesman.

In his new job for just seven months, Young says his office has made its typewriter and supplies quota year-to-date, achieved its graphics quota for the year, and is striving to catch up in magnetic keyboard equipment and Copiers. He's confident Twin Cities West will come up with the orders. "We're buying everyone refills for their pens," he says.

"As a manager," Young sums up, "you realize that you don't have a big red 'S' (for Superman) on your shirt, that you have to get the job done through people." ■

Auditors and lawmen learned long ago never to underestimate the ingenuity of an embezzler bent on fraud. With the coming of computers, that bent has been put to work in new and ingenious schemes. A recent study of bank fraud and embezzlement cases involving computer abuse showed a dozen losses, averaging out at $1-million per case. Can they be prevented? Not absolutely. Even the most exacting systems and procedures cannot be made totally foolproof—not so long as people are involved. But substantial progress has been made. Here, a report on what IBM and its customers are doing to improve data security procedures.

Putting a curb on

computer frauds

by Howard K. Janis

A British comedian once did a bit about the Great Train Robbery. "Who's behind the thieves?" a police inspector was asked. "The police are," he replied, "considerably *far behind them!"*

But not so in cases involving computer fraud. Two years ago, IBM *committed itself to an investment of some $40-million over a five-year period to study and develop data security techniques and incorporate additional safeguards into the company's products. A preliminary report on some of its initial findings was made public this year.* (See page 49). *Meanwhile,* IBM *has been working with accountants to educate them on data security procedures and techniques already available to the profession.*

Even so, experts say, most computer-related frauds can be tracked, not to a lack of data security techniques, but to sloppy procedures and a failure to institute or enforce the safeguards that do exist.

It was a routine raid—just another bookmaker in New York. But when police sifted the evidence, one thing led to another and by the time the trail ended, the head teller of a bank had been charged with the embezzlement of $1.5-million. The theft had been going on for three years, and the teller had gotten away with it by doing away with a computer printout.

The scheme collapsed when the bookmaker's records showed one of his "regulars" betting up to $30,000 a day. A police check identified him as an $11,000-a-year teller. Investigation revealed he got the money by rifling "inactive customer accounts" at the bank. Whenever a customer complained about an incorrect balance on a statement, the teller would send out a form letter blaming it on the computer, then dip into another account to make good on the "error."

How did he manage to get away with it for so long? It was a case of sloppy procedures. Although the bank ran a periodic computer check to detect signs of unusual activity in those inactive accounts, the teller knew the printouts were not being checked. So to keep the system going, he got rid of the printouts.

It's one of a wide variety of cases involving computer misuse in the last dozen years studied by Donn B. Parker of the Stanford Research Institute with support from the National Science Foundation. A report of his findings, *Computer Abuse*, has, not surprisingly, found an avid readership among banking and corporate officers from coast to coast since it appeared last year.

No one knows how many computer-related crimes have occurred, but Parker cites a dozen cases of bank fraud and embezzlement in which the computer was used. The average loss was $1-million.

What alarms many people is not the crimes themselves—even Parker concedes the total loss is relatively small—but the frequent absence of procedures and controls to even detect misuse.

Companies that suffer losses are reluctant to admit their lack of data security. So, many cases are handled privately, Parker suspects, and never come to light. He also believes that the number of incidents and the size of losses is rising.

Many financial crimes are peanuts compared to last year's Equity Funding Corp. scandal, a veritable earthquake that rocked the corporate financial world.

Investigators discovered 64,000 bogus life insurance policies in the Equity Funding Life Insurance Co., according to *Business Week* magazine. And there was only $1.1-billion insurance in force —instead of the claimed $3.2-billion. Twenty former executives and two members of Equity's independent accounting firm have been indicted on 105 criminal counts. Nine have since pleaded guilty.

The Equity Funding case—because it involved such large sums and alleged large-scale management collusion—sent shock waves through corporate board rooms.

Parker points out that Equity Funding was not primarily a computer fraud. It was a large-scale fraud, a misrepresentation involving the management itself. But one question haunts

auditors and data security experts: "Could advanced EDP auditing techniques have detected the fraud before it reached such massive proportions?"

Such widely publicized incidents have opened a new dialogue among top management, computer professionals, and those in the accounting and auditing professions.

Over the last few years, IBM has reviewed and refined data security procedures. The company's internal auditing staff has studied available techniques and developed new ones. At the outset, it was decided that the findings would be shared with outside professional accountants and auditors.

IBM has already put new procedures into effect and has begun an education program for its own auditors. The objective: To give them a basic knowledge of computers and how computer rooms should operate—what's normal activity and what's unusual or suspicious.

Last December, the company sponsored a data security symposium for 34 prominent national partners of the top 20 public accounting firms, members of the American Institute of Certified Public Accountants. And, in May, 40 members of the Institute of Internal Auditors, representing as many U.S. corporations, attended a similar symposium in Rye, N.Y. On the agenda for both groups: a demonstration of the security features of the Data Processing Division's Advanced Administrative System, at division headquarters in White Plains.

"We've let the accounting and auditing communities know that many problems *do* have answers now," says Sam Albert, DPD manager, consultants industry. "We've also tried to make it clear that IBM is committed to technological innovation in data security and to sharing what we learn."

Actually, crime was only one of a variety of data security topics at the symposiums. Errors of omission, vandalism, fire and water damage, and computer room accidents loom as much larger threats for the average company. But, as Bill Murray, DPD senior program administrator, data security, puts it: "A few years ago everybody wanted to discuss riots and bombs. Today, although incidents of alleged fraud probably amount to a minute percentage of the cases of computer misuse reported, it's the hottest subject around."

One measure: Seven times as many requests for IBM data security presentations come from high-level general management as from data processing management. Frequently, they originate with members of boards of directors who are looking closely at internal auditing.

"The goal of auditing," says C. Russell Crawford, IBM's director of internal audit worldwide, "is to protect the use of the company's assets—cash, inventory, stock, data, even equipment moving off the assembly line—by reviewing established controls and procedures to determine if they are being correctly followed, and to recommend any changes that could improve the security of assets."

Crawford acknowledges that auditors have not always had sufficient understanding of data processing. With traditional manual methods, they often audited "around" the computer—checking data that went in and what happened to it after it came out.

Curbs

Some of the techniques currently being used in computer audits

New data security techniques have been developed to help curb computer abuse. Others are still being studied.

Benjamin Conway, manager of information systems audits at Armonk, cites two examples of such techniques: First, master files can be compared from period to period to spot significant changes. Auditors can then verify additions and deletions. Second, different files that contain common data can be cross-checked. For example, a person's rate of pay recorded in a payroll file can be compared to the rate in a personnel file.

Computer programs are more difficult to protect than the files, says Conway. But IBM has developed several new tools to check programming content:

- Memory mapping, an IBM technique. It can reveal if any portions of a program were not used during a run. An unused portion can be checked to find out if it is merely obsolete, if test data is incomplete, or if it was inserted for fraudulent use.
- A trace program that stops another program after each processing step. This allows analysis of each result.
- A technique of counting the number of times each instruction in a program is used. For certain programs, the count should correspond to the known number of records being processed.
- Duplicate processing. An auditor selects the most sensitive part of a program, such as a check-writing routine or a net pay calculation. He duplicates that portion by writing it in a different code. Then he processes the transactions normally up to the point of duplication; the transactions then take the regular and duplicate programming paths. Results should be the same—unless there's been tampering.

IBM has developed other auditing security techniques but, as Conway puts it: "Audit practices have existed for at least a thousand years without totally preventing fraud. Even with the ability to audit computers, the main hope of the auditor is to act as a deterrent."

DATA SECURITY

IBM reports preliminary findings on its five-year commitment to study and develop data security techniques

Two years ago at the Spring Joint Computer Conference, T. Vincent Learson, then IBM chairman, committed IBM to an investment of some $40-million over a five-year period to study and develop data security techniques and incorporate additional safeguards into the company's products. Recently, the National Computer Conference received a preliminary report on how $2-million of that investment has been spent.

The report, from representatives of IBM and three partners in a two-year study, has produced some field-tested guidelines to protect information stored in computer files. The complete report, which points the way for future data security research, has just been published.

Participating with IBM in the study were the Massachusetts Institute of Technology, TRW Systems Inc., and the State of Illinois Department of Finance. Each participant, including the Federal Systems Division in Gaithersburg, Md., which represented IBM, carried out its own on-site project. Following are highlights of the report:

- Illinois produced its own detailed guidelines which may be helpful to other computer users. For example, a privacy action plan advises senior executives to find out what data is being collected, identify who needs it and why; to weigh the value of the information to outsiders against the risk of exposure; to review the probabilities of accidental or intentional data disclosure, modification, or destruction; and to budget for a variety of security-related costs.
- M.I.T. experimented with security techniques in a large-use, time-sharing operation, modifying an experimental IBM software tool called Resource Security System. Instead of allowing only a security officer to decide well in advance of actual operation who could use or alter particular data, M.I.T. took a less restrictive approach. It permitted the creator of the data to authorize others to read, copy, modify, or destroy the information at any time. This avoided the time-consuming procedure of having users go to the security officer for each change in authorization. It still provided a more secure system for M.I.T.'s time-sharing operation.
- TRW established a catalog of 187 security requirements as a guide to determine if a system is acceptably secure. The requirements cover five major areas of concern: separation of programs and data, control of access, identification, surveillance, and integrity of hardware and software. TRW's report called for the development of automated techniques for determining compliance with security requirements, such as analyzing the structure of an operating system.
- IBM's Federal Systems Division studied the problems of installing a secure operating system in an ongoing data processing operation. The report suggested special procedures for establishing the ownership of data in a preexisting data base.

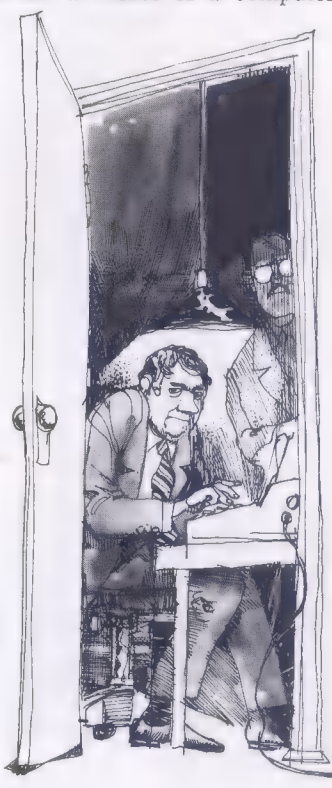
Now, with a number of new approaches, auditors have learned to *use* the computer to check what's happening *inside* a computer.

"But no matter how well you can audit anything in a computer," says Benjamin Conway, IBM's manager of information systems audits, "a computer is only a model of the real world."

Consequently, says Conway, the auditor must verify that the people on the payroll actually exist. He must make sure that inventories on the printout are on hand. He must satisfy himself that goods and services represented as purchased were received. And he must see to it that payments were received or billed by the company for its own goods and services.

"Otherwise, you may be processing a payroll perfectly with absolute control. But that payroll may contain fictitious people. You may be purchasing goods from vendors in the most economical way possible, taking advantage of every discount, but never receiving them."

When a misuse of a computer oc-



curs, says Donn Parker, more often than not it was "allowed" to happen because of "sloppy implementation" of controls and procedures. "Although it's right that we look for technological solutions," he says, "we must put far more emphasis on the human aspects of the problem. Many cases of misuse just involved the conning of people into doing unauthorized things."

Parker makes the point, too, that auditors are not the only people who must adapt to new computer technology. Awareness of data security is necessary throughout an organization, he feels, and the public attitude against misuse of computers must be strengthened.

One factor Parker finds more common among computer abusers than among other criminals is "the Robin Hood syndrome." It's the notion that while doing harm to people is immoral, doing harm to organizations is not. This type of individual finds it a very satisfying target.

"Generally," says Parker, "the people who do these things are young—18 to 30 years old—and are highly motivated, very intelligent, and ambitious. Many want instant success, money now. And they have skills, knowledge, and access to the computer."

Another common trait of computer abusers, says Parker, involves "rationalizing" the misuse by pointing out that others are doing it, too.

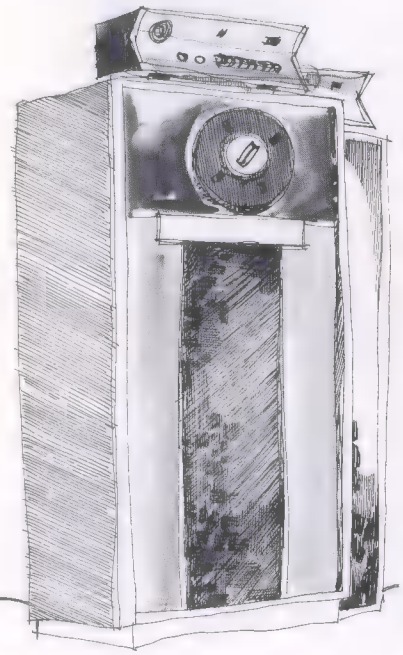
In one case, for example, a programmer stole a program from a competitor firm's computer. It turned out, Parker reports, that programmers in the two firms had been dipping into one another's computers over telephone lines—as a standard practice, known to people in both companies. They were matching wits, attempting to monitor the level of each other's computer activity, the kinds of customers served, the types of programs. The person who was caught felt terribly put upon because, "everybody else was doing it."

Over the short term, Parker expects, the more routine kinds of computer abuse will grow until more companies institute sound data security measures. Collusion, he says, poses an increasingly complex threat. For the longer term, however, he believes that new security techniques, coupled with greater management attention, will reduce the exposure from even the more sophisticated would-be criminals.

One indication of new technological safeguards: the data security features designed into IBM's recently announced virtual storage operating system, vs/2, Release 2.

But Parker also calls for more formal ethical standards in the computing field. For example, he says, programmers should universally accept the concept that programs belong to the organization that pays to have them written, not to the programmers who write them.

"The computer itself," Parker concludes, "is an ideal tool to detect in detail any kind of unusual activity resulting from human intervention in data handling—activity that might indicate unauthorized or criminal activities." ■



Fifteen years ago, people asked if data processing would shrink the accounting profession. Today, the answer appears to be, "far from it."

- Membership in the American Institute of Certified Public Accountants has soared to over 100,000 from 38,000 in 1960.
- An IBM computer users' group called ACUTE (Accountants Computer Users Technical Exchange) had six members in 1967. Today, there are more than 120.
- Revenue of accounting firms has topped an estimated $3-billion, up from $500-million in 1948.
- There has been an additional spurt in professional consulting, often called "management services," which involves giving advice on data processing. These services, says Sam Albert, Data Processing Division's manager, consultants industry, now account for an estimated 25 percent of the accounting profession's revenue.

The complexity of new data base/data communications systems, Albert explains, has made it more difficult for CPA firms to advise their clients on data security. Yet the CPA, he points out, feels more responsibility than ever before to ensure a proper system audit. Otherwise, he can't certify a company's financial statement.

"People ask CPAs and consultants, 'What can I do to prevent a computer-related fraud?' says Albert. "We do many things to educate the consultants on the state of the data security art and what IBM is doing."

Among the avenues of communication: symposiums for CPA and customer people concerned with data security; executive computer concepts courses; security and new auditing information in customer education courses; special technical manuals of interest to CPAs and auditors; and a DPD newsletter, *Management Services Update*, mailed to over 20,000 CPAs and consultants twice a month.

Need technology spell trouble

No, says this scientist. But he warns that civilization *is* headed for trouble if it continues to charge ahead on technology without first assessing the side effects.

by Jerome B. Wiesner, President
Massachusetts Institute of Technology

As president of M.I.T., and formerly as science advisor to President Kennedy, I have been attacked as a symbol of those scientists and engineers responsible for what is considered by some to be the evil impact of technology on our way of life. My exposed position has caused me to work hard to identify and understand the many problems that we face, to examine the underlying causes and to search for ways of dealing with them. In the course of this I have come to regard the various individual problems that confront mankind as aspects of a closely interrelated and ongoing evolutionary process. This viewpoint is essential, I believe, if we are to understand and cope with the multicrises of our times.

There are many examples of the shortcomings of dealing piecemeal with the aspects of society's growth, the energy shortage being the most recent and most dramatic. It required ignoring the combined effects of new environmental controls and policies on natural gas pricing, conservation, taxes, highway construction, and public transportation; a concentration of research on nuclear power; and a neglect of fossil-fuel technology, and automotive engine technology; and the lack of a petroleum stockpile policy and building codes (plus many factors I have no doubt left out) in order to create the remarkable mess we have on our hands today. It will take attention to all of these matters combined to insure an adequate and stable energy supply for the future.

Most of the unexpected and serious side effects of the application of technology—including growth and complexity which were made possible by technology—have become major threats because we didn't fully appreciate the power of exponential growth, or perhaps even recognize that it was a factor to be considered. We perceived social phenomena

Dr. Jerome B. Wiesner, president of M.I.T. since 1971, has long helped shape national policy on science and technology. During the early Sixties, he served as special assistant to President John F. Kennedy for science and technology, chairman of the President's Science Advisory Committee, and director of the newly established Office of Science and Technology. This article is based on his address at the University of Notre Dame, marking the centennial of its School of Engineering.

and we responded to them—or did *not* respond—as though we lived in a linear world in which there was plenty of time in some distant future for someone else to correct the little troubles we preferred to ignore today. But exponentials cannot be ignored for very long.

For example, to provide an increment of 7 percent in our petroleum supply this year would require an amount of oil approximately equal to the total amount consumed in 1950. It is these exponential factors in resource consumption, waste production, population expansion, and of the other things that are growing that we must face up to. They cannot be stopped suddenly. The world system has its own dynamics and time constants but we can be conscious of their effects and try not to make the system do impossible things.

Incidentally, the *antagonists* of science and technology go wrong in a similar way. They also tend to project a future that is a linear extrapolation of the past and this leads to what are called "doomsday" predictions. I believe that there is at least some evidence to warrant the view that modern man can learn to modify his behavior fast enough to avoid the catastrophic disasters that some see ahead.

I see a mighty task here for us engineers. That's what engineering is all about—the creation of machines and processes and modes of thinking that help man do his work more easily and live his life more satisfactorily. And that is what the engineers and scientists of the nation have been doing with great success, at least when measured against the traditional standards of a healthier, more affluent life, an increasing life span, a growing level of agricultural output, the general availability of manufactured goods; that is, in terms of the general welfare of the citizens of the so-called developed countries.

Nonetheless, despite our many achievements there has been considerable and growing unease about the prospects for the future, about where advancing technology may be taking us, what it is doing to our spirit, a questioning of the physical and social environment that is emerging, a fear that affluence today is being purchased by mortgaging tomorrow's resources. Thoughtful people realize that the human race is facing some very special problems, that crises seem to be more complex and are arising more rapidly than ever before, that there are no easy solutions. Some more imaginative worriers fear that as things are evolving, vital life support systems will fail completely one day, like the great Northeast power failure, except that it will happen in many areas simultaneously and it won't turn on again. Those who see the cause of these situations in the growing impact of technology generally articulate one of two specific worries.

First, there is the widespread belief that many of society's serious difficulties stem from the careless or malicious exploitation of technology—and, second, and obviously more serious, a growing conviction that the increasing size and complexity of a modern industrial society has created a system that is beyond man's management ability. The only cure, if any, is said to be to drastically limit the future uses of technology. I do not agree.

I believe that a very serious problem exists, but that it is not the result of carelessness or malicious intent, and that the solution lies in learning how to better manage the society in all of its aspects, including the development and use of new technology, not in the hankering after a false notion of some preindustrial utopia. The Congress has recently established the Office of Technology Assessment—known as the OTA—to provide itself with a means of judging the technical programs it is asked to support. Many other groups have also been created to study aspects of these problems. These can be found in universities and nonprofit study centers, corporate planning organizations, and in many other branches of government here and abroad. The OTA has been deluged with requests for program assessments. Many of these requests involve studying the interactive effects of one group of initiatives on others. They typically involve technical, economic, environmental, and humane questions. It is clear that the methodology does not yet exist for dealing with these problems and the staff, consisting largely of engineers, social scientists, and lawyers, is going to have to do a good bit of experimentation and depend heavily upon outside help.

But the establishment of the OTA demonstrates that we have learned an important lesson—that civilization cannot any longer charge ahead, applying technology blindly and capriciously, without getting into serious trouble. We now understand that we have the capacity to affect our environment in all of its aspects with such power and on so large a scale that the consequence could threaten our very existence. Now the task is to develop our capacity to cope with the problem.

This task will be extremely difficult for it will not only require bringing together people from many disciplines to carry out the studies but it will require a continuous communication with representatives of many, perhaps most,

elements in the society. The end product will perhaps be experimental, too, involving new technology and new ways of organizing and managing our affairs—in contrast to the unrecognized experimentation we have been doing on a grand scale all along.

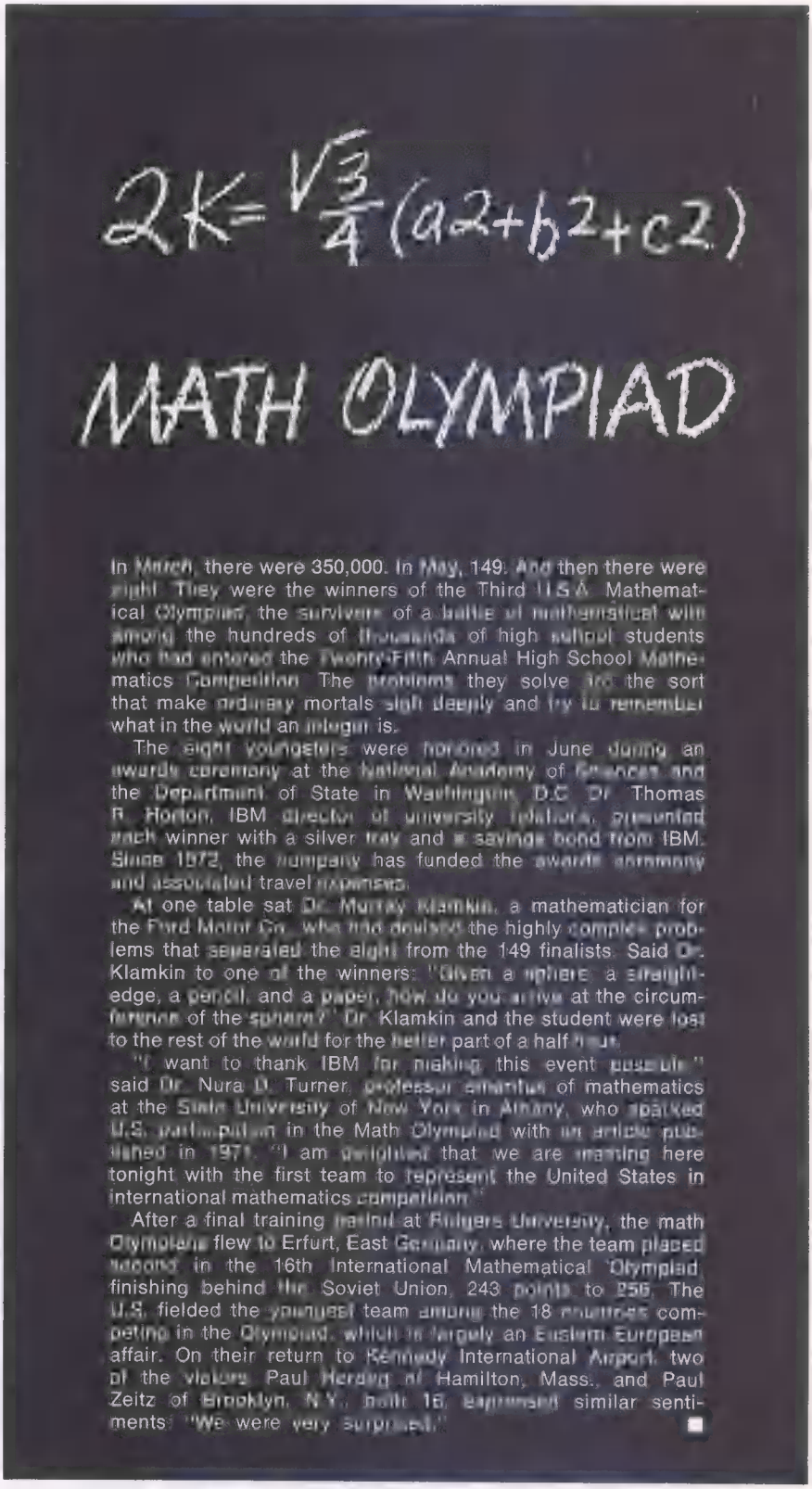
* * *

Here then is a "prescription" for the next few decades as I see them. Most of the problems facing our nation—and, indeed, the whole world—whether they are shortages of food or potential shortages of energy or other resources, or the need to protect the natural and man-made environment, will require substantial doses of innovative technology if they are to be mitigated. But the technology can only be effective if it is created in the context of a realistic understanding of the need and a careful assessment of its impact. This calls for sensitively relevant technology—conceived and developed by a new generation of applied scientists and engineers whose education includes a solid scientific and engineering base, plus the education and viewpoint needed to comprehend the institutional engineering problems.

To accomplish this, engineering education must include a good knowledge of the systems concepts, i.e., an understanding of how groups of things and people behave when they are forced to interact. The contemporary engineer must also have a broad background in social science, in particular, economics, political science, psychology, and management—plus a well-developed humanistic streak. We now recognize that it is necessary to be concerned about the total impact of the large-scale exploitation of any technology and to be on the lookout for unexpected side effects which can occur.

We also see the need to develop the capability to evaluate rationally the alternate courses of action and to choose among them, particularly when new technology is proposed. We need to develop the means of communicating the range of available choices—and the reasons behind them—to the other members of our society, a difficult task in a situation in which few people will have the expertise to understand either the details of the specific issues or the dynamics of their interactions. Through this all, our goal should be to manage the change rather than have it manage us.

Above all, we need the humility to admit that we will not find any absolute answers or permanent solutions, so that we are prepared to face a continuously evolving world, confronting us with ever new problems. ■



In *March*, there were 350,000. In May, 149. And then there were eight. They were the winners of the Third U.S.A. Mathematical Olympiad, the survivors of a battle of mathematical wits among the hundreds of thousands of high school students who had entered the Twenty-Fifth Annual High School Mathematics Competition. The problems they solve are the sort that make ordinary mortals sigh deeply and try to remember what in the world an integer is.

The eight youngsters were honored in June during an awards ceremony at the National Academy of Sciences and the Department of State in Washington, D.C. Dr. Thomas R. Horton, IBM director of university relations, presented each winner with a silver tray and a savings bond from IBM. Since 1972, the company has funded the awards ceremony and associated travel expenses.

At one table sat Dr. Murray Klamkin, a mathematician for the Ford Motor Co. who had devised the highly complex problems that separated the eight from the 149 finalists. Said Dr. Klamkin to one of the winners: "Given a sphere, a straightedge, a pencil, and a paper, how do you arrive at the circumference of the sphere?" Dr. Klamkin and the student were lost to the rest of the world for the better part of a half hour.

"I want to thank IBM for making this event possible," said Dr. Nura D. Turner, professor emeritus of mathematics at the State University of New York in Albany, who sparked U.S. participation in the Math Olympiad with an article published in 1971. "I am delighted that we are meeting here tonight with the first team to represent the United States in international mathematics competition."

After a final training period at Rutgers University, the math Olympians flew to Erfurt, East Germany, where the team placed second in the 16th International Mathematical Olympiad, finishing behind the Soviet Union, 243 points to 256. The U.S. fielded the youngest team among the 18 countries competing in the Olympiad, which is largely an Eastern European affair. On their return to Kennedy International Airport, two of the visitors, Paul Herzog of Hamilton, Mass., and Paul Zeitz of Brooklyn, N.Y., both 18, expressed similar sentiments: "We were very surprised." ■

People

World Cup champs

As Henry Kissinger, Prince Rainier and Princess Grace of Monaco, and other fans gathered in Munich's Olympic Stadium to see the 10th world soccer championship contest, more than 500 million people around the globe watched the game on television. Among them: Peter Beilke, manager of data services at IBM's Computing Center in Hamburg, and Rainer Kratzsch, who headed the center's programming efforts to provide credentials and distribute press seats for 2,000 journalists covering the final round for the world's soccer cup in nine West German cities.

Beilke, 32, who like most of the 2.5 million soccer club players in his country learned to play in the streets and schoolyards, could hardly contain himself as West Germany battled its way to the championship.

Kratzsch, 30, relished the programming more than the event itself. "I prefer to play with my head rather than my legs," says Kratzsch, who likes the Japanese game, Go.

When the whistle sounded for the preliminary match against Poland, Beilke excused himself and hurried off to watch the contest with a Polish IBMer. It was an upset victory for the Germans.

"The Dutch are said to be somewhat stronger," said Beilke before the championship game, "but no matter."

West Germany prevailed, 2-1.

Fitness

They're issuing sweat suits as well as management advice at Sands Point these days. At 7 a.m. three days a week, students in the Advanced Management School and Executive Program arrive at the clubhouse for 45 minutes of voluntary calisthenics and jogging before the start of class. And they like it. Well over 90 percent of the students sign up, and more than 60 percent of them continue the regimen when they get home.

Most of the executives, like Joe Hamaguchi, director of DP operations for IBM Japan, haven't done leg lifts, windmills, or any other regular exercise since school or the service. Hamaguchi, 47, has picked up where he left off nearly 23 years ago. "People who are fighting with papers

Presidents' Class

Simon Sheib doffed his jacket and for five days got caught up in the whirl of data processing. Nothing unusual about that except that Sheib is president and chief executive officer of Avnet, Inc., a conglomerate with sales over $350-million and a rank of 332 on *Fortune*'s list of the 500 largest industrial corporations.

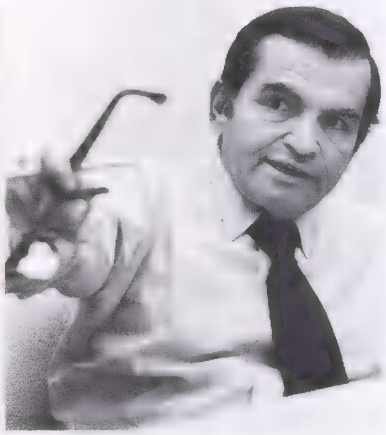
How could he afford to take time out for the Presidents' Class in data processing at the IBM Poughkeepsie Education Center? To hear Sheib tell it, he couldn't afford *not* to. "I get as many as 20 requests a year from different units of my company for new data processing equipment," he says, "plus requests to do this, that, and the other thing with computers. I needed to know more about computers so I could make intelligent decisions."

A capsule view of IBM people and events around the world

all day long," he says, huffing through the mile run with 15 classmates, "have to make a point of using their bodies."

Bill Grabe, Data Processing Division regional manager in Detroit, was simply getting back on the track. Grabe, 36, used to run regularly in Denver before he moved to Detroit six months ago. "It's encouraging," he says, "that IBM is recognizing the importance of physical fitness."

Each participant has his or her doctor's approval. Pulse rates are closely monitored during the program. "With the right attitude, supervision, and knowledge," says Dave Rodes of the North Shore Health Club in Manhasset, N.Y., who runs the 17-month-old program, "it's never too late." When Joe Hamaguchi gets back to Tokyo, he expects to get up early for a jog through the neighborhood with his wife, Iku.



By the time the course was over, Sheib—like more than 3,000 other customer executives who have traveled into the once-mysterious world of data bases and teleprocessing at Poughkeepsie, Endicott, and San Jose—was filled with confidence in the computer as a tool for decision-making. "I'm going back to New York City," he said, "to explore new ways to organize our data."

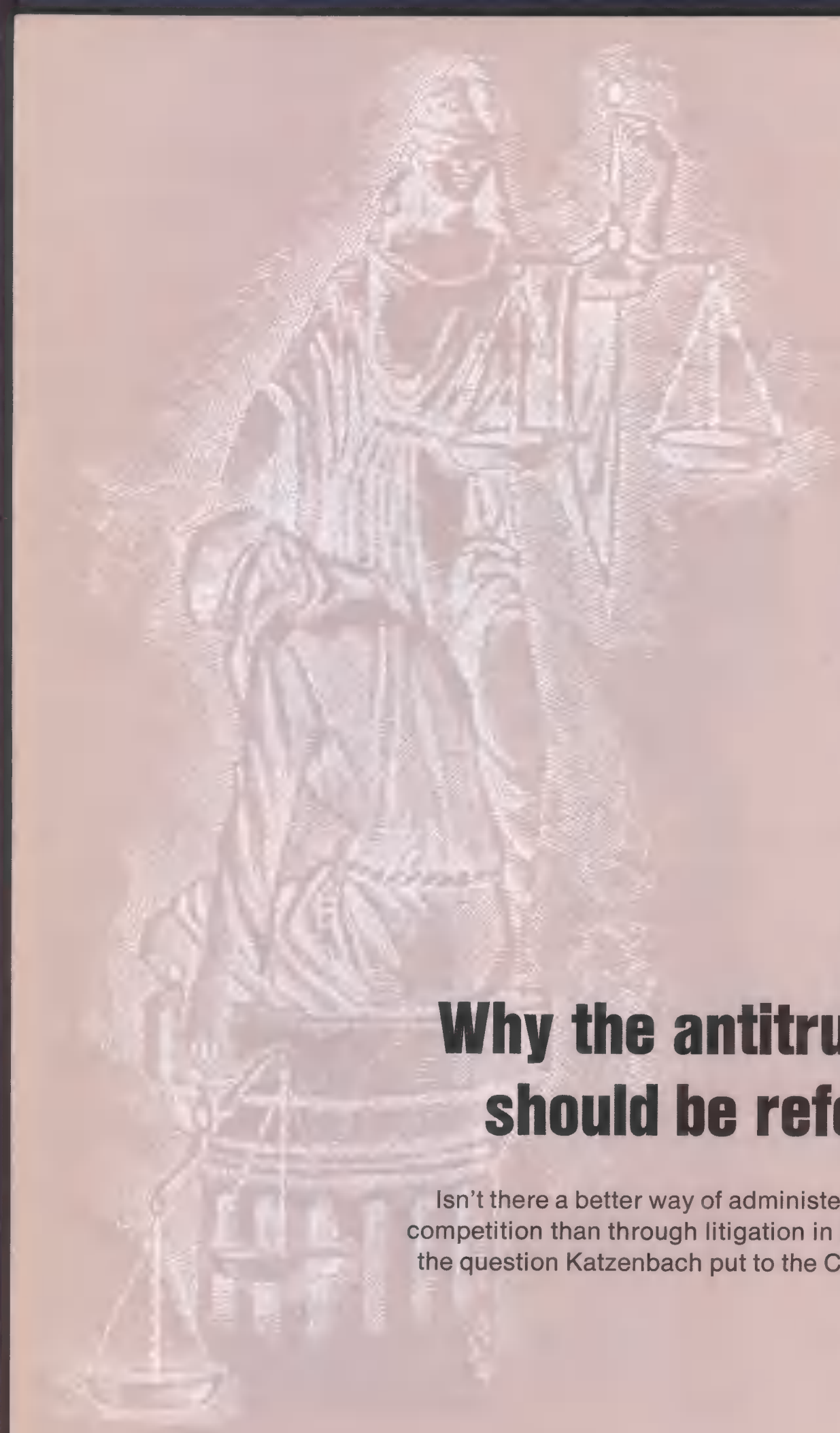
ACM head

"Of course I'm pleased," says Jean Sammet, recently elected to a two-year term as president of the 29,000-member Association for Computing Machinery (ACM).

The first woman president, and the second IBMer (Walter Carlson, Corporate marketing consultant, was the first) to head the oldest and largest society in the field of information processing, needs no introduction to her fellow professionals, inside or outside IBM.

Programming language technology manager of the Federal Systems Division at Cambridge, Mass., Miss Sammet has pioneered the development of higher level languages since serving as a key member of the group which first developed COBOL in 1959. Her 816-page book, *Programming Languages: History and Fundamentals,* published by Prentice-Hall in 1969, is known widely as the standard work on programming languages.

Her hopes for the ACM: "We have to strike the right balance between concentration on detailed technical work and involvement of the computing profession with society as a whole."



Why the antitrust laws should be reformed

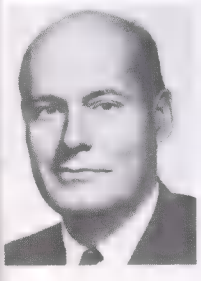
Isn't there a better way of administering laws affecting competition than through litigation in the courts? That was the question Katzenbach put to the Congress last month.

In recent testimony before the Senate Antitrust and Monopoly Subcommittee, IBM *Vice President and General Counsel Nicholas deB. Katzenbach asked Congress to consider new factors affecting competition and better ways of enforcing antitrust law. Following, the major portion of his statement.*

It is unfortunate, somewhat unfair, and clearly unnecessary for the Committee to hold these hearings [on the electronic data processing industry] at this time and under these circumstances: unfortunate, because the Committee deprives itself of expert testimony which would otherwise be available; unfair, because, whatever the Committee's intentions, there may be misinformation about, criticism of, and attacks upon IBM which it cannot rebut in present circumstances and which make this record useless as a basis for legislation; unnecessary, because all relevant information about the industry will be available to the Committee soon in a far more comprehensive, objective, and useful form.

These conclusions stem from the fact that the trial of the case of *United States v. IBM* is scheduled to commence before Chief Judge David Edelstein of the Southern District of New York on October 7. The issues in that case, probably the most important and certainly the most complex in the history of the Sherman Act, are broad and will, necessarily, involve extensive testimony on the history of the industry, its competitive structure, the practices of IBM and others, over a period of years, both here and abroad. The facts relevant to the decision of the case—and to the work of the Committee—will be brought forth, as they should be, in an objective forum; tested for accuracy by the examination and cross-examination of witnesses under oath by counsel who are not only expert in the law but who have spent literally years in preparation of the case.

This case has been pending for over five years. Hundreds of thousands of hours have been spent on both sides in its preparation; millions of documents containing statistics, plans, analyses of decisions, etc., have been studied; and many hundreds of persons from IBM, from the Government, and from hundreds of other companies with relevant information or expertise have been formally deposed. The Department of Justice has stated to the Court its intention to use some 160 persons as witnesses at trial, and IBM has similarly listed some 400 persons. These persons include experts of all types—economists, accountants, investment analysts, scientists, and engineers. They also include many competitors, customers, and more than 100 representatives of Federal departments and agencies whose testimony by deposition will be offered by IBM. It has involved and will involve immense cost and effort to the Government and to IBM—but it does and will provide all the factual information necessary for the work of this Committee. This Committee may question whether or not this long and expensive process is the best, speediest, and cheapest way to develop such information. But there can be no serious question that this process will provide incomparably more accurate, less biased, more comprehensive, and better informed facts than this hearing.



Nicholas deB. Katzenbach, IBM *vice president, general counsel, and a member of* IBM*'s board of directors, served successively as U.S. Attorney General and U.S. Undersecretary of State before becoming* IBM*'s chief legal officer in January 1969. Before joining the Justice Department, he taught law at the University of Chicago and Yale Law School. He writes occasionally, most recently for* Foreign Affairs *magazine.*

Much information will be adverse to IBM . . . to permit such attack on the eve of a trial is unfair.

If nothing more were involved, I would, therefore, wonder why—with all this information about the industry soon to be available—the Committee is holding these hearings. It cannot be to develop relevant information.

Only the Committee can answer that question. But lest anyone draw mistaken inferences from my question, let me make it unequivocally clear that I intend no implication of an improper motive on the part of the Committee, any desire to be unfair, any intention to attempt to influence the result of an important antitrust case on the eve of trial.

I cannot speak with the same conviction about some of the witnesses the Committee has seen fit to invite, though again I do not impugn the motives of the Committee. And whatever is said in these hearings, I have no doubt that IBM will get a fair trial in court.

But to say that, is not to say that these hearings will not prejudice and damage IBM in other ways. In honesty, I believe they will. For they are almost certain to generate testimony and opinion adverse to IBM in circumstances under which IBM cannot properly respond, offer contradictory testimony, or otherwise defend itself. And while none of this will affect the judicial process, and hopefully not the testimony of witnesses, it may suggest to the general public, to unsophisticated investors, and even to some of our own employees that IBM is guilty of something improper. They will wonder why these hearings are held, why such distinguished senators do not take exception to at least some of

the testimony you will hear, and why—most of all why—IBM does not set the record straight.

The members of this Committee, all distinguished lawyers, understand why it would be improper for me as counsel to testify publicly about any of the issues in pending cases. The members of this Committee will understand why I would not want—putting ethics aside—to attempt to try IBM's case in this forum. And those who are close to the litigation will know that IBM and the Government are bound by court order to limit scrupulously their comments to the press about the matters involved in the antitrust litigation.

Much of the information developed at these hearings will be adverse to IBM; that IBM cannot defend itself at this time in this arena; and that to permit such attack—indeed, to provide a public forum for it on the eve of a trial important to this country and important, certainly, to IBM and its stockholders—is inherently unfair. Not, to repeat, because it will influence the results of the trial, but simply because the trial in and of itself highlights interest in these hearings.

The facts about this . . . dynamic industry are far more complex . . . than can be comprehended in a few short hours.

There are many—investors, employees, customers, competitors—who want to guess the results of this litigation simply because they fear it will affect them. And there will be those who do seek to influence public opinion in ways adverse to IBM and who will promote views prejudicial to IBM in every way they can.

As the Committee knows, Messrs. [Dan L.] McGurk and [A. G. W.] Biddle of the so-called Computer Industry Association have as the principal objective of their employment to make public attacks upon IBM in the interest of their members, a number of whom are suing IBM in the courts. The C.I.A. is not representative of the computer industry. There are such organizations, with significant membership, but representatives of those organizations do not appear on the Committee's witness list.

The Committee has also invited two economists to testify. Professor Brock recently completed, under the tutelage in part of one of the Government's principal experts, a Ph.D. thesis on the computer industry, which is an important source of the Government's theory of the case against IBM. Similarly, Mr. Miller is an economist who has worked in the Department of Justice, and who has been engaged for some time in assisting in the preparation of the Government's case. Therefore, if these gentlemen in fact testify, the Committee will be exposed to the Department of Justice's view with no opportunity for rebuttal by IBM. I say, *if* these gentlemen both testify, because it seems to me that the Department may make efforts to persuade them not to, when their testimony is so closely related to the Department's pending case.

Two witnesses are employed by Control Data Corporation, an important IBM competitor, which sued IBM on antitrust grounds in a case now settled. I do not, of course, know the nature of their testimony.

Another heads a company which is also in competition with IBM. He has been a frequent public critic. The two gentlemen from overseas have governmental responsibilities which will inhibit any testimony favorable to IBM.

As members of the Committee know, a number of European governments, working in conjunction with the European Economic Community, are subsidizing and otherwise supporting IBM's European competitors.

I assume that there may be other witnesses whose names are included on the list in an effort to balance the testimony in some way or other. I do not know this for a fact, since I do not know, of course, what their testimony will be. And, indeed, some of the witnesses are unknown to me or to my colleagues in IBM, and accordingly I know neither their qualifications nor their views.

I say all this merely to demonstrate that it would be unlikely that this Committee could get any kind of in-depth knowledge from this number of witnesses in a few hours of testimony, irrespective of their objectivity or their expertise. The facts about this young and dynamic industry are far more complex, as the scope of the Government trial indicates, than can be comprehended in a few short hours. And, to repeat, if the Committee seriously wants to study the industry, it will have the wherewithal to do so from the record of the Government case. It cannot hope to achieve that understanding in these hearings. It *can* promote misunderstandings prejudicial to IBM.

I accept the fact that there can be and are circumstances where the fact of pending litigation should not inhibit the need of Congressional Committees to seek information relevant to pending legislation. But these hearings do not fit those circumstances. The information developed, irrespective of predictable bias, will be woefully inadequate for any responsible judgments. And accurate and complete information is and will be available to the Committee from other sources.

I would like to comment briefly on the broader subject of the work of the Committee. I do so because I am personally sympathetic with the need to review the purposes and the enforcement mechanisms of governmental policy towards competition.

Hart Committee

The senator is worried about concentration

Senator Philip A. Hart (D., Mich.) became chairman of the Senate Antitrust and Monopoly Subcommittee (the second largest subcommittee in the Senate) in 1963, following the late Senator Estes Kefauver in the post. In recent years, the Hart Committee has held hearings on the auto repair industry, the insurance industry, hospital costs, and aspects of the fuel industry. Though no major legislation has resulted, his findings have been passed along to the Justice Department, the Federal Trade Commission, and to other regulatory commissions for their action.

Sen. Hart favors reshaping the country's major industries in such a way as to lessen what he considers overconcentration of economic power. In July 1972, he introduced the initial version of his Industrial Reorganization Act upon which the current round of hearings are being held. In contrast to the traditional approach to antitrust, which generally has been to define and prosecute practices that courts find to be in restraint of trade, the Hart Bill would permit the prosecution of companies because of their size alone.

The Hart Bill *(S.1167)*, which declares monopoly power unlawful, would establish a presumption that monopoly power exists if:

- a corporation has a rate of return on net worth in excess of 15 percent over five years;
- there is no substantial price competition between two or more companies in any market;
- or, if four or fewer companies account for 50 percent of the sales in any market.

Hart would create a commission and court to curtail concentration in seven major industry groups. These are: chemicals and drugs; electrical machinery; computers and communications equipment; iron and steel; energy; motor vehicles; and non-ferrous metals. These industries, Sen. Hart contends, account for nearly 40 percent of U.S. manufacturing.

Sen. Philip A. Hart

Nicholas deB. Katzenbach

Neither the Congress nor the Executive has a clear, consistent, well-thought-out philosophy with respect to laws governing competition—what we loosely call "antitrust." The Sherman Act, perhaps wisely, is cast in very broad terms and has evolved over the years in efforts to adjust to changing circumstances. In the course of this evolution, problems have emerged on which this Committee could usefully focus attention.

I think it important that the Government attempt to articulate the philosophy which underlies our governmental policies toward business competition and the factors which should be taken into consideration in its enforcement. At present there are conflicting and inconsistent strains running through our antitrust laws as they have been interpreted by Government officials and by courts. Indeed, the record of your own hearings suggests the lack of a coherent philosophy among those regarded as expert in the field.

At bottom there are two conflicting themes. One is that the purpose of the law is to promote competition by protecting competitors from the rigors of tough competition. While this is somewhat of a mercantile view—everyone has a right to stay in business—it gets a more appealing populist aura by often being presented as protecting small competitors from large ones, whether or not this protection results in benefits to the consumer. Undeniably this philosophy can have an emotional appeal, but it may be quite inconsistent in concept and result from a philosophy which holds that the objective of competition is to promote the welfare of consumers by encouraging an economic system in which there are rewards for those who are innovative, who can achieve efficiencies, who can provide better products at lower prices.

Some resolution of this basic conflict as to the objectives of laws governing competition has become both more important and more difficult as many new factors have entered the equation as a result of new technology, industrial maturity, and a shrinking world. Surely our philosophy of competition must take into account our more general economic and political objectives, our ability to compete in world markets, the fact that other governments may not share our economic views or may have conflicting objectives in terms of trade, commerce, and investment. The efforts by this Committee to consider such problems are to be applauded. But, as the Committee knows, much more work and analysis needs to be done.

Not only are these problems important to clarify and resolve, but the business community has an interest in their discussion, analysis, and resolution. I think, too, that this Committee has an interest in enlisting the efforts of the business community in that work. Unfortunately, much of the business community regards itself in an adversary position with the Committee—and understandably. The

proposed legislation is cast in terms which promote confrontation rather than objective inquiry. Not only does this adversely affect business cooperation in matters important to that community, but it promotes committee investigations and hearings on precisely the issues which are currently the subject of judicial and administrative hearings, again in an adversary context which is bound to be viewed as unfair and prejudicial by defendants.

Let me turn briefly from the philosophy of laws regulating competition to enforcement mechanisms. Clearly enforcement suffers not only from lack of a coherent philosophy and conflicting interpretations, but also from the lack of consistent and purposeful administration. And each aggravates the other.

From the national viewpoint, enforcement lies largely in the hands of the Assistant Attorney General in charge of the Antitrust Division of the Department of Justice and the members, especially the Chairman, of the Federal Trade Commission. Both operate with very little guidance from more senior Administration officials or the Congress. There is no guarantee that these policy officials agree on objectives—or even jurisdiction—and the rapid turnover of policy-making personnel in both the Department and the Commission in relation to the time consumed in investigation and litigation, virtually ensures unevenness and inconsistency in enforcement. And, in my experience at least, there is no satisfactory mechanism for ensuring that enforcement takes into account other economic objectives of a particular Administration or of the Congress.

. . . the Committee's work will be most productive when . . . directed to clarifying our philosophy of competition.

All that would be chaotic enough, but it is in fact much worse. The growth of private treble damage suits in the past two decades has meant that a number of private attorneys, representing private clients and not necessarily the public interest, have been promoting interpretations of the antitrust laws consistent with their clients' interests and large contingent fees. Each such decision creates legal precedent and thus serves to develop economic policy removed from Congressional oversight and Executive supervision while placing it in the hands of some 450 district court judges, who, unavoidably, have different degrees of experience in economic theory and business practices, and who must formulate their decisions in a framework of facts and policies articulated by private counsel.

I do not have problems with private treble damage cases where the issues involved are unlawful practices: price fixing, agreements not to compete, discriminatory pricing, etc. Here it may well be useful to engage the efforts of the private bar. But where the issues involve structure—where the lawfulness of a particular practice totally depends on definitions of monopoly power, market, and fundamental economic analysis, it is unwise to leave development of basic national economic policy to a process as unstructured and unguided as private litigation. And I regard it as particularly dangerous to the serious public interest where the lawyers involved may have a huge financial stake in the decision itself.

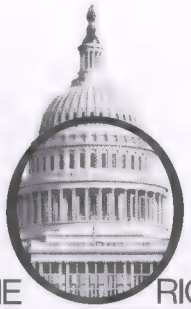
There are problems, too, with the treble damage suits which may follow a successful antitrust victory by the Department of Justice. Such suits impose huge, and perhaps senseless, burdens on an already overburdened judiciary. I say "senseless" for three reasons: (1) the "damages" involved are always speculative, involving guesses which in other contexts would be regarded as inappropriate for resolution by either judge or jury; (2) the trebling of such damages is from a plaintiff's viewpoint a pure windfall in a context where there is little public interest in proliferating litigation after the basic economic policy has clearly been established by the relief granted in the underlying governmental proceedings; (3) in this context, it is again the lawyers who benefit the most at the expense of an overworked Federal judiciary.

My opposition to treble damage cases following a successful Government antitrust case does not stem from any belief that defendants who are found guilty of criminal practices should not be severely punished. They should be. Existing fines are, I believe, far smaller than desirable. But severe fines, accompanied by equitable relief, should serve to deter unlawful practices, which is after all the underlying purpose of the statutes.

Finally, the Committee is well advised to consider, as it is considering, whether or not judicial enforcement in the first instance is the best way of administering laws affecting competition. Federal courts are presently overburdened with work, these cases are large and complex, and there is little provision in present law for judges to secure adequate professional assistance and help in complex economic litigation.

In addition—and this fact goes to more than the work of the Committee—Federal judges are grievously underpaid for the importance of their work and the experience and skill which we must attract to the bench. In addition, in many parts of the country, court facilities are woefully inadequate; the Southern District of New York is one where that situation is particularly bad.

These are difficult problems, particularly in the political and economic climate prevailing today. I do not have satisfactory answers to many. I do believe that the work of the Committee will be most productive when it is directed to clarification of the basic objectives of our philosophy of competition and to the mechanisms of its implementation, and least productive when it appears to be examining precisely those issues which are subject to current litigation and which, inevitably, result in partisan approaches to problems which are important to all of us to resolve in nonpartisan ways. ■



THE ORIGINS AND INTENT OF ANTITRUST LAW

(Continued from page 9)

other, and agree not to sell in each other's business preserve, the courts invariably declare their agreement illegal, as equivalent in every way to price fixing.

However, a smaller company, trying to gain or hold a share in a large market, may find geographically defined exclusive franchises nearly indispensable to its business needs, and therefore "reasonable" in an antitrust sense.

I have chosen these groups of cases simply to illustrate the nature of the influence the antitrust laws bring to bear on our economy. The same themes arise in cases dealing with mergers; international cartels; patents, trademarks, and trade names; professional sports; practices in the distribution of goods and services; and many other areas of the economy. The American antitrust laws are a pervasive force in American business. Generally speaking, they are administered to encourage legitimate enterprise, and to condemn restraints of competition. Sometimes their application seems perverse—the protection of small competitors from the inevitable consequences of competition. Especially in recent years, decisions have been criticized as anti-competitive in spirit and effect.

What these opinions stress is that there should be special antitrust scrutiny for firms which possess 'monopoly power.'

The readers of *Think* are naturally interested in a particular panel of the antitrust law, that concerned with monopoly and monopolization. IBM is now enduring an epidemic of litigation under Section 2 of the Sherman Act.

The fear of genuine monopolies—the single-firm companies dominating the major industries of the nation 80 years ago—was the principal force behind the passage of the Sherman Act. And for a generation the classic Trusts were the major target of antitrust enforcement efforts.

Antitrust enforcement; the impact of two World Wars; growth; and the technological transformation of economic processes have completely altered the structure of the American economy. The old one-firm Trusts in major industries have disappeared. The development of transportation has opened local markets to wider and wider zones of competition, and to new methods of distribution. The multiplication of substitute commodities and services, too, has been a force weakening monopoly influence in many situations of importance. The railroads, to take an obvious example, do not have the immense monopoly power of their position only 60 years ago. Steel, coal, and many other products face an array of competition from substitutes—aluminum, oil, plastics, glass.

Nonetheless, the problem of monopoly in our economy has remained significant, and has continued to command the interest of economists and of the Department of Justice. And it has taken on new dimensions which have occasioned intense controversy.

The modern law of monopolization under Section 2 of the Sherman Act begins with the opinion of Judge Learned Hand in the *Alcoa* case in 1945, and that of Judge Charles Edward Wyzanski, Jr., in the *United Shoe Machinery Company* case, decided in 1953.

What these opinions stress is that there should be special antitrust scrutiny for firms which possess "monopoly power" in the economic sense—that is, firms which provide all or nearly all the supply of the markets in which they function; or otherwise hold the power to control the prices at which they sell, or the power to limit the competitive opportunities of their rivals. The possession of "monopoly power" in the economic sense, these cases point out, is not the whole of the legal offense of "monopolization." One must *have* "monopoly power" in order to "monopolize." But, in addition, there must be an element of conscious policy in order to convert an economic condition into a violation of the statute. The Sherman Act is a criminal law, after all. And our legal system does not impose penalties without some evidence of personal wrongdoing. As Judge Hand remarked in *Alcoa,* the Sherman Act uses the verb, *monopolize,* not the noun, *monopoly*.

In monopolization cases, the government or the private plaintiff must prove that the defendant has actually monopolized. What *Alcoa* did, however, was to divide the process of proof into stages. In the first stage, the plaintiff has to prove only that the defendant or defendants have held monopoly power in the economic sense for a significant period of time. (The courts are not impressed by the transitory economic monopoly enjoyed by the seller who introduces the market to a new product which is soon copied.)

However, these decisions say that the continued possession of monopoly power for an extended period—more than 20 years in *Alcoa,* and more than 50 in the *United Shoe Machinery* case—establishes a presumption that the monopolist has indeed monopolized. The courts assume that the monopolist has been aware of his monopoly.

Once this presumption is established, the task of the defense becomes more onerous. It must take the initiative in bringing forward evidence to show that the defendant or defendants have not monopolized in the legal sense, but that their economic position of monopoly is the inevitable result of circumstances beyond their control.

The *Alcoa* and *Shoe Machinery* cases, among others, recognize that monopoly power in the economic sense can be "thrust upon" a company, even if it has done nothing to restrict the competitive opportunity of its rivals. It can

show, for example, that it has grown to a monopoly position because it was technically or managerially better than its rivals—that it has built a better mouse trap, in effect; because its competitors had withdrawn from the field, or fallen by the wayside; or because economies of scale permitted it to offer the whole supply required by the market at prices lower than any its rivals could match. Under these circumstances, the courts have said, the defendants' economic monopoly would not be considered a legal monopolization. In Judge Hand's words: "The successful competitor, having been urged to compete, must not be turned upon when he wins."

But the monopolist will be considered to have monopolized when the record shows that he has achieved and retained his economic monopoly deliberately. It used to be thought that it was necessary to show that the defendants had maintained their economic monopoly by devices which were in themselves violations of the antitrust law, or abusive and unethical practices in a vaguer sense—such as a policy of buying out rivals; long-term contracts which blocked out the possibility of entry by competitors; and the like. Actually, the earlier cases never really insisted on such a rule. And the modern cases make it clear that no such rule exists. What is required to convert economic monopoly into legal monopolization is a demonstration that the monopolist has kept his monopoly by optional policies; that is, by policies not forced upon him by market circumstances nor the necessity for survival itself—policies which in their business context had the purpose or effect of preventing the entry of rivals, or imposing a special obstacle on their fair competitive opportunity.

. . . the court must understand the economic impact of the behavior being challenged . . .

Alcoa, United Shoe Machinery, and the cases related to them, raise two generic issues: defining the relevant market, the first problem in every antitrust case; and distinguishing legal and competitive business behavior from evidence of monopolizing.

The definition of the market appropriate to an antitrust case is drawn from two sources: the charges in the complaint or indictment; and the economic facts of life. The court must answer a simple question: Have the defendants violated the antitrust laws in certain specified ways—that is, by performing certain alleged acts? As we have seen, the heart of that question is whether the defendants' behavior, if proven, is an undue limitation on competitive conditions in a market. In cases under Section 2 of the Sherman Act, it must be shown first that the defendant holds a full market position of monopoly in the economic sense.

To make that kind of determination, the court must understand the economic impact of the behavior being challenged—its effect on the price or output of one or more products, in one or more market areas.

A market is a forum, a gravitational field, in which economic rivalry takes place. It must be defined both by product and by space. Are beer and Coca-Cola in the same market? Coca-Cola and ginger ale? Is there a national soft-drink market? A soft-drink market in Atlanta? The answer depends in part upon what has been charged, in part upon economic realities. Defendants may be charged with restraining competition either in a national or in a local market; in a broad product field (steel, aluminum, shoe machinery); or in a narrow subfield (wire-rope, aluminum sheets, certain classes of shoe machinery). The validity of such distinctions, the Supreme Court has ruled in the two leading cases on the subject—*United States v. Columbia Steel Co.,* and the *Cellophane* case, *United States v. E. I. DuPont de Nemours and Co.,*—depends upon whether the alleged markets are genuinely separated from others by discernible and significant gaps in cost, consumer preference, price, or time.

If IBM has an absolute right to meet competition economically . . . could the exercise of that right violate the . . . laws?

If consumers or suppliers outside the supposed market respond promptly to relatively small changes in the prices which prevail within it—that is, if there is effective cross-elasticity either of supply or of demand—the proposed definition of the market fails. There was no "market" for cellophane, the court said, because a small change in the price of cellophane caused many users of the product to shift to other transparent wrapping materials.

The distinction between the permissible and impermissible responses of large companies to business conditions is an even more embattled ground these days. The *Alcoa* decision is probably the most vivid and most important statement of these principles in the literature.

At the time of the trial reviewed in the 1945 *Alcoa* opinion, Alcoa was the only producer of virgin aluminum ingot

in the United States. Its position in the industry had been based originally on valid patents. But Alcoa had remained the only producer of virgin ingot for many years after its patents expired in 1912.

The court refused to believe that this extraordinary result had been achieved in a fit of absent-mindedness, and without deliberation. The technology of the industry was well known. Raw materials were available. There was some evidence in the record that Alcoa had engaged in a price squeeze, and some other tactics designed to handicap potential entrants into the business.

But the court rested its conclusions on a broader ground. Alcoa had an economic position of monopoly in what the court then considered to be a distinct national market for virgin aluminum ingot. While ingot made from scrap competed with virgin ingot to some extent, the court decided to exclude secondary ingot from the relevant market in its 1945 opinion, since the supply of scrap was then ultimately under Alcoa's control. (Later, after other companies had entered the field, the definition of the relevant market changed.) Alcoa's economic monopoly after 1912, the court ruled, became an illegal monopolization because of deliberate policy choices Alcoa was free to make.

It was not an accident, or an inevitable response to market forces, or just the result of superior skill, energy, and enterprise, the court concluded, which led Alcoa to embrace each new opportunity as it became available, and to confront every potential competitor with the threat of an overwhelming array of capacity and business preparation.

Similarly, in the *Shoe Machinery* case, the court found that the defendant, almost unchallenged, had held an economic position of monopoly for 50 years in the business of supplying machinery for the manufacture of shoes. That monopoly position was retained, the court concluded, through the use of a number of business policies the company deliberately adopted for the purpose. The defendant might have chosen alternative policies, if its goal had not been to consolidate and maintain its position of monopoly.

The paradoxes inherent in these decisions are illustrated by the current *Telex* suit against IBM. Telex, a manufacturer of peripheral data processing equipment which can be plugged into IBM computers, charges that during the period from 1968 to 1972 IBM had monopolized or was attempting to monopolize a certain submarket of the general computer market by driving Telex and like manufacturing companies out of it.

Telex and other manufacturers of peripheral equipment had gained ground rapidly at the expense of IBM, starting in 1966, and at an accelerating pace after 1968. Losing large amounts of business to its rivals, and confronting the return of many of its products marketed under short-term leases, IBM not only developed new and improved equipment, but reduced its prices and modified its distributive practices in response to unmistakably ominous market pressures.

Were these responses evidence of active competition, or proof of a purpose to drive IBM's rivals out of the market? If IBM has an absolute right to meet competition economically—that is, by prices above incremental costs—could the exercise of that right violate the antitrust laws?

It is hard for me to imagine . . . that competitive price reductions . . . can be regarded as 'predatory.'

The United States District Judge found that the market relevant for the purposes of Telex's suit was not the general market for electronic data processing equipment, which includes 96 companies making complete computer systems. Rather, it was a distinct market, supplied by IBM and about 100 small companies, for peripheral equipment which can be plugged into IBM central processing units, and distinct submarkets as well for plug-compatible tapes, disks, memories, and printers.

The trial judge reached this conclusion despite the fact that he found a considerable degree of interplay among all parts of the market. It was easy and cheap, he agreed, to make nearly any peripheral device compatible with IBM central processing units. All the systems on the larger market, and the equipment for them, were in quite active and direct competition with each other.

The critical fact which led the judge to his market definition, he said, was the pervasive influence and leadership of IBM in the industry, an influence he found had persisted despite the fact that in the electronic data processing industry as a whole, IBM's market share had fallen to 35.1 percent, because of the entry of a considerable number of strong, well-financed, and technically competent competitors.

A second reason for the judge's decision was that IBM's business strategy of response to the market forces which were reducing its sales in the late Sixties was directed to marketing possibilities in these sectors of the market.

Under the court's definition of the market, IBM invariably starts with a monopoly position, since the market consists initially of its own products, which other companies then copy or adapt for use with IBM computers. The essence of IBM's market strategy was to reduce the prices it charged on its own equipment in order to be able to market it. It is conceded that these prices are well above IBM's costs. The district judge found the

price reductions were "predatory" nonetheless, because they were part of a deliberate plan to recover and hold a monopoly position in the market he had defined—the market, that is, for peripheral data processing equipment which can be plugged into IBM central processing units.

The case is now before the United States Court of Appeals for the Tenth Circuit. That court, and probably the Supreme Court of the United States later on, will have to answer a number of questions of great moment not only to the litigants, but to the policies of competition the antitrust laws are intended to promote.

My own answers to these questions should be obvious from the argument of this paper.

First. Where the charge is that a defendant's conduct constitutes monopolizing—or attempting to monopolize—the effect of that conduct on competition has to be determined throughout the economic zone affected by it. In the *Telex* situation, IBM's business strategy directly affected the marketing of all peripheral equipment and indeed of all EDP systems as well, since there was cheap and prompt interaction to price changes—a high degree of cross-elasticity both of demand and of supply—among all the parts of the EDP equipment market.

Second. It is hard to see how it can be claimed that any firm has or can hope to achieve a position of economic monopoly in the EDP market, which is one of the most dynamic and turbulent in the American—and world—economy. New firms enter every part of that market freely, and on a large scale. Prices and market shares vary. Products change with bewildering rapidity. There can be no comparison, for example, between the market position of IBM in this market and that of Alcoa in the aluminum industry between 1912 and 1945, or that of the United Shoe Machinery Company in the shoe machinery business for more than half a century before 1953.

My conclusion would be the same even if I could conceive of a separate "market" for peripheral equipment plug-compatible with IBM central processing units. So long as it is easy and cheap to make other equipment compatible with IBM central processing units, and IBM does not tie its peripheral equipment to the processing units by contract—which would be obviously illegal—how could IBM's position in that market be considered one of monopoly? And why should it be forbidden to compete on economic terms with rivals who offer such equipment to the consumer?

The best evidence that IBM lacked the essential element of monopoly power in either market—that is, a degree of control over the prices it charged—is the fact that it lost business to competitors on a large scale until it reduced prices.

Third. The response of IBM to the erosion of its business in peripheral equipment is markedly different from the business practices found to be evidence of monopolization in *Alcoa* and *Shoe Machinery.*

In the first place, IBM's market position cannot be described as one of economic monopoly in any recognizable market, for the reasons I have just commented on. But *Alcoa, Shoe Machinery,* and the other cases under Section 2 of the Sherman Act necessarily turn on the existence of a monopoly position whose deliberate retention or extension the law tries to prevent.

Secondly, IBM's market campaign to regain lost business was not an optional policy choice, as was the case both for Alcoa and for United Shoe Machinery. A sharp competitive response to competitive setbacks in a market of rapidly changing market shares is quite different from a business strategy which preserves a position of economic monopoly over a long period of time.

It is hard for me to imagine that the Supreme Court will hold, under these circumstances, that competitive price reductions—to levels well above incremental costs—can be regarded as "predatory." Large and small companies have equal rights to compete. The injuries they incur or inflict in the course of competition have traditionally been labeled *damnum absque iniuria*—loss or damage without legal redress. This, I believe, is the sound answer to Telex's claims for antitrust damages.

In the context of the history of the antitrust laws, a contrary decision would represent a sharp and radical change of policy. As we have seen, the main theme of that history has been to encourage robust and equal competition, and to prevent private power from restraining it. Unsubsidized private competition, well within the economic norms of cost, cannot be characterized as a restraint of competitive conditions or an act of private coercion. To label such behavior as "predatory" would repudiate the animating purpose of the antitrust tradition in American law, and legislate new rules of protection against competition for large areas of American business. ■

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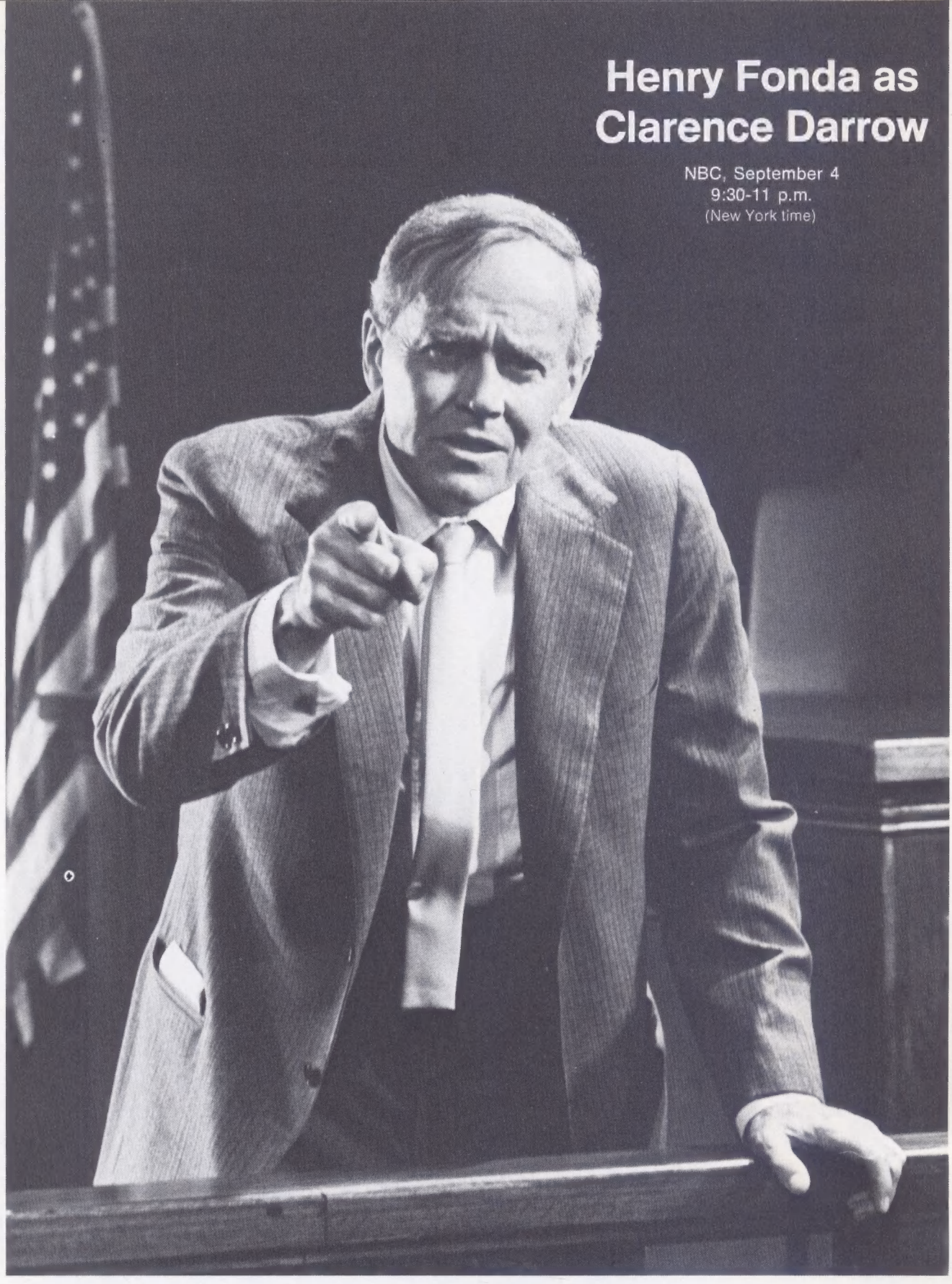
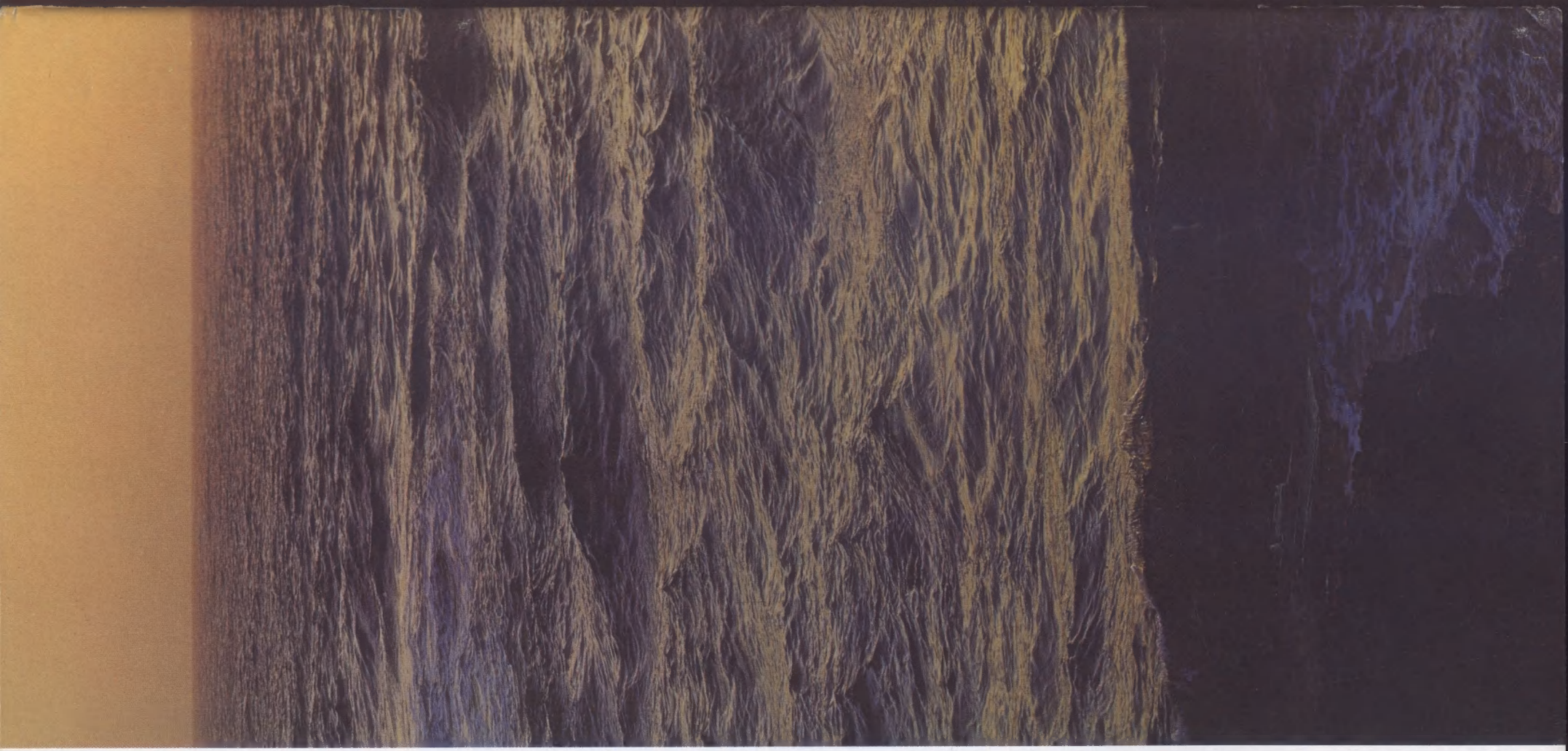


Henry Fonda as Clarence Darrow

NBC, September 4
9:30-11 p.m.
(New York time)

"I urge everyone, man, woman and child interested in justice and America, to see this play. For that matter I urge everyone interested in consummate acting and the ultimate in courtroom drama to see it." Strong words. They come from Clive Barnes, a critic for *The New York Times,* and he's talking about the recent stage hit, *Clarence Darrow,* starring Henry Fonda. A television adaptation of the play will be sponsored by IBM as a color special on NBC, Wednesday, September 4, 9:30-11 p.m. (New York time).

Fonda also stars in the TV version of the one-man play, which is based on Irving Stone's book, *Clarence Darrow for the Defense.* Taped for television this summer in Los Angeles and a stage success in seven cities, Fonda as Darrow reminisces about the life and career of the great defense lawyer, who took up unpopular causes—often for the poor, the dispossessed, and the minorities—with a passion.



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